JPRS 75114

12 February 1980

USSR Report

EARTH SCIENCES

No. 3

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semimonthly by the NTIS, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Indexes to this report (by keyword, author, personal names, title and series) are available through Bell & Howell, Old Mansfield Road, Wooster, Ohio, 44691.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

Soviet books and journal articles displaying a copyright notice are reproduced and sold by NTIS with permission of the copyright agency of the Soviet Union. Permission for further reproduction must be obtained from copyright owner.

50272-101

REPORT DOCUMENTATION PAGE

1. REPORT NO. JPRS 75114

2.

3. Recipient's Accession No.

4. Title and Subtitle
USSR REPORT: EARTH SCIENCES, No. 3

5. Report Date
12 February 1980

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

Joint Publications Research Service
1000 North Glebe Road
Arlington, Virginia 22201

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address

As above

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This report contains abstracts of formal scientific reports and news items on Soviet research in the earth sciences, including meteorology, oceanology, and geophysics. Information on current Arctic and Antarctic expeditions is also provided.

17. Document Analysis a. Descriptors

USSR
Earth Sciences
Geophysics
Meteorology
Oceanology
Arctic
Antarctic

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group 08, 04, 17-F, I, J

18. Availability Statement
Unlimited Availability
Sold by NTIS
Springfield, Virginia 22161

19. Security Class (This Report)
UNCLASSIFIED

20. Security Class (This Page)
UNCLASSIFIED

21. No. of Pages
55

22. Price

(See ANSI–Z39.18)

OPTIONAL FORM 272 (4–77)
(Formerly NTIS–35)
Department of Commerce

JPRS 75114

12 February 1980

USSR REPORT

EARTH SCIENCES

No. 3

CONTENTS

PAGE

I. METEOROLOGY 1

Interaction Between Ocean and Atmosphere in Tropical Cyclone Region 1

Background Ozone Content in Atmosphere 2

Effect of Heat Reserve in Ocean on Typhoon Trajectories 3

Sensitivity of Discrete Models of Dynamics of Atmosphere and Ocean 3

Determination of Pressure and Geopotential from Radiothermal Sounding 4

Review of Literature on Winter Anomaly in the D Region 5

Hydromet Research Ship "Korolev" Cruises Pacific Area 6

II. OCEANOGRAPHY 7

Meandering of the Lomonosov Current 7

Analysis of Frequency-Angular Wind Wave Spectra 8

Effect of Sea Water Scattering Indicatrix on Nonstationary Light Field 8

Electromagnetic Fields of Short-Period Waves 9

Fluctuations of Scattering and Attenuation of Light in Sea Water 10

Holographic Methods for Marine Geophysical Research Tested 11

[III - USSR - 21K S&T]

CONTENTS (Continued) Page

Wind Effect on Large-Scale Ocean Currents.................. 11

Propagation of Shot Waves in Stratified Ocean............... 12

Remote Investigations of Internal Waves in Ocean............ 13

Correlation Between Small-Scale Turbulence and Water Stratification.. 13

Red Sea Expedition Tests "Paysis" Manned Submersible........ 14

Upper Ocean Layer as an Energy Sink for Internal Waves...... 15

Method for Sounding the Ocean Floor......................... 15

Characteristics of Sources of Microseisms................... 16

Modern Problems in Geophysical Research in Ocean............ 17

Review of Status of Investigations of Attenuation of Wave Movements.. 17

Research Ships to Study Red Sea Using Manned Submersibles... 18

III. TERRESTRIAL GEOPHYSICS.................................. 19

Correlation Between Seismicity and Solar Activity........... 19

Thermal Convection in the Earth's Upper Mantle.............. 20

Effect of Slant Discontinuity on Behavior of Rayleigh Waves. 20

Deep Structure of the Ocean Floor........................... 21

Combined Electric Prospecting and Gravimetric Work.......... 22

Use of Electromagnetic Fields in Predicting Earthquakes..... 22

Characteristics of Arches in Layers Above and Below Salt Structures.. 23

Seismotectonic Deformation of Garm Region................... 24

Mechanism of Deformation of Seismically Active Crustal Volume.. 24

Parameters of Activity of Weak Crustal Earthquakes.......... 25

CONTENTS (Continued) Page

Methods for Studying Deep Structure of the Upper Crustal Layers.......... 25

Tectonomagnetic Investigations in Polygons.................. 26

Multiparameter Method in Direct Search for Petroleum and Gas.......... 27

Method for Analysis of Geomagnetic Field Time Series........ 28

Geomagnetic Variations as Earthquake Precursors............. 28

New Tectonic Maps and Descriptions of Siberia............... 29

Aerospace Methods Used in Exploration for Petroleum and Gas. 30

Space Mapping of Tectonic Structure of Ural-Volga Interfluve.......... 31

Remote Methods for Studying Geological Structure of Petroleum-Gas Regions.......... 32

Theoretical Analysis of Development of Shear Waves at Earthquake Focus.......... 33

Method for Analysis of Structure of Seismic Field........... 34

Recent Movements of Earth's Surface in Uzbekistan........... 35

Application of Radiometric Methods in Studying Recent Movements.......... 35

Anomalous Magnetic Field in Northwestern Turkmenistan....... 36

Correlation Between Strong Earthquakes and Solar Wind Parameters.......... 37

HF Electromagnetic Radiation Accompanying Seismic Activity.. 38

Velocity Characteristics of Crust in Issyk-Kul' Depression.. 39

Automation of Radiogeodetic Measurements.................... 39

Activation of Weak Seismicity as Predictor of Strong Earthquakes.......... 40

CONTENTS (Continued) Page

Structure of Field of Stresses at Focus Accompanying Shot in Soft Ground.. 41

Determination of Parameters of Geocentric System of Geodetic Coordinates.................................... 42

Temporal Variations of High-Frequency Seismic Noise....... 42

Radiation of Compressional and Dilatational Waves by Shear Fault... 43

IV. PHYSICS OF ATMOSPHERE... 45

Depth of Penetration of Electrons Artificially Injected into Ionosphere.. 45

Method for Determining Electron Density Profile........... 46

Winter Radio Wave Absorption Anomaly in Auroral Zone...... 46

Atomic Nitrogen in Upper Polar Atmosphere................. 47

Characteristics of Potentials and Electron Fluxes in Auroral Magnetosphere.................................. 48

Adiabatic Transfer of Auroral Particles in Magnetosphere.. 48

Allowance for Double Scattering in Lidar Sounding......... 49

V. ARCTIC AND ANTARCTIC RESEARCH.................................. 50

Soviet Polar Explorers to Investigate East Antarctica..... 50

Scientific Expedition to Antarctica....................... 50

Additional News from Antarctica........................... 51

I. METEOROLOGY

INTERACTION BETWEEN OCEAN AND ATMOSPHERE IN TROPICAL CYCLONE REGION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 249, No 2, 1979 pp 467-470

[Article by G. G. Sutyrin and A. P. Khain, Institute of Oceanology and USSR Hydrometeorological Scientific Research Center, "Interaction Between Ocean and the Atmosphere in the Region of a Moving Tropical Cyclone"]

[Abstract] Very few data have been available on interaction between a tropical cyclone and the underlying surface. Until now in mathematical models of tropical cyclones the temperature of the underlying surface has been considered stipulated. In studies of the ocean's reaction to a passing tropical cyclone the wind stress at the ocean surface has usually been stipulated. Accordingly, the authors present an example of computations based on joint use of a model of a tropical cyclone and the upper layer of the ocean, taking into account interaction between the ocean and the atmosphere. In the numerical example a tropical cyclone developed in 35 hours from an initial eddy in gradient balance with a constant temperature of the ocean surface. During the next 70 hours its characteristics remained virtually unchanged. Further evolution of the tropical cyclone was computed taking into account interaction with the upper layer of the ocean. In the initial horizontally homogeneous state of the ocean the depth of the thermocline was selected at 70 m; the temperature drop in the upper layer of the ocean was 10°C. As a result of vertical turbulent mixing and heat transfer into the atmosphere the temperature of the ocean surface is reduced. Evaporation is reduced. Weakening of the tropical cyclone becomes appreciable several hours from the moment of onset of interaction. The maximum temperature drop of the ocean surface is 3° and is observed in the region of position of the typhoon at the moment of onset of interaction. As a result of the decrease in intensity of the tropical cyclone the cooling of the ocean surface decreases with time. An intensive upwelling develops behind the center of the tropical cyclone. Despite strong turbulent mixing the thickness of the mixed layer decreases. Inertial fluctuations of thickness of the mixed layer exert virtually no effect on its temperature because the mixing weakens greatly after passage of the tropical

cyclone. Therefore, the principal factor causing the cooling of the ocean surface is vertical turbulent mixing in a zone of strong winds. On the periphery of a tropical cyclone the role of mixing in cooling of the ocean surface becomes comparable with the role of heat loss into the atmosphere. Figures 1, tables 1; references 6: 3 Russian, 3 Western. [123-5303]

BACKGROUND OZONE CONTENT IN ATMOSPHERE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 249, No 6, 1979 pp 1339-1341

[Article by F. Ya. Rovinskiy, V. A. Popov, L. N. Chernykh, V. I. Yegorov and Yu. N. Persin, Institute of Applied Geophysics, "Background Ozone Content in Near-Earth Atmosphere"]

[Abstract] The background ozone content in the near-earth atmosphere has not been adequately studied. It is generally believed that the concentration of ozone having a natural origin (mean monthly maximum hourly concentrations) falls in the range from 20 to 80 $\mu g/m^3$. During 1976-1978 measurements of the background ozone concentrations were made at two stations using ozone chemiluminescent analyzers. Air samples were taken at a height of 2 m from the ground surface. The results were recorded continuously with 30-minute averaging. The measurement results were used in determining the diurnal variation of ozone concentrations, averaged for the entire observation period. The experimental data can be divided into two groups. The first are characteristic of observation regions which are distant from local sources of anthropogenic contamination of the atmosphere. The second group includes data on ozone concentrations in regions where the influence of urbanized regions is possible. The minimum background values are observed in regions where there is no influence of local sources of atmospheric contamination. The diurnal variation of ozone concentration for continental regions has a daytime maximum which can be associated with an increase in the rate of vertical transfer of ozone in the near-earth layer during daytime and a subsequent decrease in the height of mixing of the air layer after sunset. In the case of an urbanized atmosphere an increase in the ozone concentration after sunrise can be caused by an increase in the rate of transpiring of photochemical reactions leading to its formation. A substantial role can also be played by the horizontal transfer of contaminated air masses. An analysis only of the diurnal variation of ozone does not make it possible to draw any unambiguous conclusion concerning the mechanism of its formation in the measurement region; additional investigations are needed. Over the European territory of the Soviet Union the maximum ozone concentrations in all observation regions can vary from 50 to 125 $\mu g/m^3$. Figures 2, tables 1; 11 references: 4 Russian, 7 Western. [176]

EFFECT OF HEAT RESERVE IN OCEAN ON TYPHOON TRAJECTORIES

Moscow OKEANOLOGIYA in Russian Vol 19, No 6, 1979 pp 1002-1007

[Article by V. D. Pudov, Institute of Experimental Meteorology, "Effect of Heat Reserve of Upper Ocean Layer on Typhoon Trajectories"]

[Abstract] The author analyzed the trajectories of motion of typhoons across the ocean when the distribution of the heat reserve of its upper layer is known. As the initial data use was made of hydrological investigations in the Pacific Ocean in an area bounded by 20-28°N, 143-151°E and data from a hydrological profile along 148°E from 20° to 17°N carried out during the expedition "Tayfun-78." In addition, data on typhoon trajectories were available for this region for 1966-1975. Data from the hydrological survey were used in computing the heat reserve of the upper layer of the ocean along 148° between 17° and 23°N. The rates of movement of typhoons across this region were computed for the period from 1966 through 1975 for determining the dependence of typhoon trajectories on the heat reserve in the upper layer of the ocean. A histogram was constructed to show the variability of the rate of movement of typhoons in the region over a 10-year period. It appears that the rate of movement of typhoons passing through the region with an increased heat reserve between 18 and 23°N is reduced as a minimum by 20%; the variability of the rate of movement of typhoons following one another at short time intervals decreases. These findings confirm the significant role of the heat reserve in the upper layer of the ocean in the forming of typhoon trajectories. The passage of a typhoon leads to a decrease in the heat reserve in the ocean by an extremely significant value. It is clear that with the passage of the next typhoon at a time interval less than is necessary for restoration of the initial heat reserve the variability of its rate of movement will be less. The greatest variability of typhoon trajectories must be expected in regions with a marked change in the heat reserve of ocean waters.
Figures 3, tables 2; references 15: 8 Russian, 7 Western.
[179]

SENSITIVITY OF DISCRETE MODELS OF DYNAMICS OF ATMOSPHERE AND OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 15, No 11, 1979 pp 1123-1131

[Article by G. I. Marchuk and V. V. Penenko, Computation Center, Siberian Division USSR Academy of Sciences, "Investigation of Sensitivity of Discrete Models of Dynamics of the Atmosphere and Ocean"]

[Abstract] The methodological problems involved in investigation of sensitivity of discrete models of dynamics of the atmosphere and ocean by numerical methods are presented. There are many problems related to the sensitivity of such models in connection with the mathematical modeling of the atmosphere and ocean. These include: 1) Evaluation of variations

of the solution or functionals of the solution in dependence on variations of the input parameters and prediction of the behavior of the solutions in the neighborhood of a known solution. 2) Evaluation of variations of the parameters on the basis of variations of the solution. 3) Refinement and optimization of the parameters of the models on the basis of experimental data and matching of the initial fields in accordance with the stipulated criteria. 4) Evaluation of the influence of random changes in the parameters of the models or initial conditions, extrapolation of the solution with random variations of the input parameters. 5) Analysis of the influence of errors in approximation and rounding-off in the solution of problems on an electronic computer. 6) Evaluation of the limits of the region of system stability. The sensitivity functions of the model are determined as the influence functions of changes in the parameters in relation to solution of the problem. Investigation of sensitivity involves study of behavior of the model in parameter space. Mathematically the determination of the sensitivity functions essentially involves computation of the partial derivatives of the sought-for solution or of the functionals determined in a set of solutions on the basis of the parameters of the model in the neighborhood of unperturbed values. Three methods for determining sensitivity are discussed in this paper: 1) direct modeling; 2) based on equations in variations; 3) using adjoint equations of hydrothermodynamics. The practical applications of these methods are discussed. Each of the methods has its own field of application. The first two make it possible to evaluate the field of variations or the functions of sensitivity of the vector of state, whereas the third makes it possible to evaluate the variations and functions of sensitivity of functionals.
[152-5303]

DETERMINATION OF PRESSURE AND GEOPOTENTIAL FROM RADIOTHERMAL SOUNDING

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 15, No 12, 1979 pp 1316-1318

[Article by Sh. D. Kitay, A. P. Naumov and M. I. Sumin, Gor'kiy Radiophysics Scientific Research Institute, "Determination of Pressure and Geopotential from Results of Radiothermal Sounding of Atmosphere in Region λ 5 mm"]

[Abstract] In atmospheric sounding in the O_2 resonance region centered at $\lambda\sim 5$ mm in different variants (from the earth's surface, from aboard an aircraft and from an artificial satellite) it is customary to ascertain the dependence of temperature T on pressure P in the lower atmosphere and below the flight level. In this paper the authors have endeavored to evaluate the accuracy in determining pressure and geopotential from the results of both numerical studies and real experiments for ascertaining temperature in remote sounding. In the statistical regularization method use is made of the vector

$$T(P) = T^{ex}(P)+(K^{*}WK+B_{TT}^{-1})^{-1}K^{*}W\delta T_{br\nu}(\theta).$$

In this formula $T^{ex}(P)$ is the temperature profile, obtained by the statistical extrapolation method from the surface values T_0, $\delta T_{br\nu}(\theta)$ is the deviation of the brightness temperature T_{br} of the atmosphere with the sounding parameters (ν, θ) from the corresponding T_{br}^{ex} value computed from the extrapolated values of the meteorological elements, K is a matrix obtained with quadrature of the initial equation, B_{TT} is the autocorrelation matrix of temperature, W is the matrix of errors in measuring $T_{br\nu}(\theta)$, * denotes transposing of the matrix. A numerical experiment for ascertaining the T(P) profiles was also carried out using the formula cited above for ~100 results of aerological sounding during each of the winter and summer mid-seasonal months (January, July) for 3-4 years in the central part of the European USSR. Provided the temperature profiles are sufficiently smooth, an acceptable accuracy in determining atmospheric pressures can be expected. If temperature inversions are present, the errors in determining T(P) increase somewhat. A conversion from the dependence T(P) to the vertical temperature profile T(h) at standard levels was accomplished using the full barometric formula. Various possible errors are examined and special cases are considered. [151-5303]

REVIEW OF LITERATURE ON WINTER ANOMALY IN THE D REGION

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19, No 6, 1979 pp 961-980

[Article by A. D. Danilov and S. Yu. Ledomskaya, "Winter Anomaly in the D Region — Aeronomic and Meteorological Aspects — Review"]

[Abstract] The authors have drawn upon 158 published sources in the literature in preparing this review of aeronomic and meteorological aspects of the winter anomaly in the D region. The anomalous absorption of radio waves is caused by a considerable increase in the electron concentration at altitudes 75-90 km with a maximum of the effect at about 80-85 km. The amplitude of [e] change can attain an order of magnitude or more. The increase in the electron concentration occurs due to an increase in the concentration of the ionizable agent and a decrease in the relative fraction of ion bonds, causing a decrease in the effective recombination coefficient. A decrease in the effective recombination coefficient occurs due to an increase of the temperature of the neutral gas at altitudes 75-90 km during the time of the winter anomaly and other factors. An increase in the NO concentration results in a change in the ion composition at these altitudes. Other photochemical reactions follow. At any rate, the photochemical part of the winter anomaly problem is relatively clear, but the reasons for the [NO] and T changes associated with

dynamic, circulatory and thermal regimes of the entire middle atmosphere still require explanation. There are three possible "scenarios" describing the mechanism of increase in the quantity of [NO]. All three possible "scenarios" relate the increase in [NO] concentration observed during the time of the winter anomaly to dynamic processes having a global character and affecting the entire thickness of the stratomesosphere. The reasons for the second factor causing the winter anomaly phenomenon, the temperature increase, are still less clear but they evidently are closely related to the dynamic and thermal regime of the entire middle atmosphere. Despite the successes of recent years, much research must be carried out in this field, including many-sided study of ionospheric, stratospheric and mesospheric parameters. Figures 10; references 158: Russian 51, Western 107.
[124-5303]

HYDROMET RESEARCH SHIP "KOROLEV" CRUISES PACIFIC AREA

Moscow VODNYY TRANSPORT in Russian 13 Dec 79 p 3

[Excerpt] The "Akademik Korolev" is one of the leading ships of the Eastern Hydrometeorological Scientific Research Institute of the USSR State Committee on Hydrometeorology and Environmental Monitoring (GOSKOMGIDROMET). On board the ship are 29 laboratories, including those for hydrochemical, meteorological, ionospheric and synoptic studies. Each is equipped with the most modern research apparatus, which makes possible a broad range of research both in the atmosphere -- using meteorological rockets, radiosondes and data from meteorological satellites, -- and in the ocean -- using buoy stations, water samples from great depths, etc. A computer to process the research materials is installed on board. A few days ago the "Akademik Korolev" left its port of registry in Vladivostok and set out on its 26th ocean cruise. The purpose of the expedition is to conduct the final stage of the Soviet and Swedish SKOPE committee's project to study the biogeochemical cycle of sulfur in the environment. The ship's route will be: Vladivostok-Nakhodka-Wellington-Callao-Los Angeles-Singapore-Vladivostok. This area represents the region of the globe that is most isolated and remote from anthropogenic impact. One of the main tasks of the expedition will be to study atmospheric conditions and pollution.
[172-P]

II. OCEANOGRAPHY

MEANDERING OF THE LOMONOSOV CURRENT

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 248, No 5, 1979 pp 1229-1232

[Article by A. A. Zaytsev, A. B. Zubin and Corresponding Member USSR Academy of Sciences A. S. Monin, Institute of Oceanology, "Meandering of the Lomonosov Current"]

[Abstract] Data from measurements of currents obtained on the 28th voyage of the scientific research ship "Akademik Kurchatov" during March-April 1979 using ten self-contained buoy stations on two meridional runs across the equator (18.5° and 23.5°W) convincingly show that the "core" of the Lomonosov Current is subject to fluctuations both in latitude and in depth. The meandering is therefore two-dimensional (discovery of this fact was one of the attainments of this voyage). During the period of observations the latitudinal deviations of the axis of the Lomonosov Current from the equator were 55-75 km (30-40' in latitude). The period of latitudinal meandering was approximately 12-16 days, but this period was not rigorous. The variations of the current in depth were 30-40 m. The changes in the depth of the core and the current boundaries in general were not in phase. Reliable registry of emergence of the Lomonosov Current at the ocean surface was still another of the attainments on the 28th voyage of the "Akademik Kurchatov." The authors have estimated the principal parameters of meanders of the Lomonosov Current: period, wave length and phase velocity. A hypothesis is presented on the mechanism of generation of meanders of this current. The observed meandering of deep equatorial countercurrents had earlier been predicted by A. S. Monin. Evidently, the growth of synoptic eddies, arising as a result of baroclinic instability of currents, flow around bottom irregularities or atmospheric disturbances in the equatorial zone or outside it, leads to the formation of Rossby waves in the ocean. They excite wave movements in the thermocline which are the meanders of the Lomonosov Current.
[102-5303]

ANALYSIS OF FREQUENCY-ANGULAR WIND WAVE SPECTRA

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 15, No 11, 1979 pp 1175-1187

[Article by V. V. Yefimov and Yu. P. Solov'yev, Marine Hydrophysical Institute, Ukrainian Academy of Sciences, "Dispersion Relation and Frequency-Angular Wind Wave Spectra"]

[Abstract] The peculiarities of the frequency spectra are discussed on the basis of an analysis of the results of multipoint synchronous measurements of wind waves. By means of computation of frequency - wave number spectra the authors obtained estimates of the functions of angular distribution of energy in different frequency ranges. Following a direct experimental checking of the dispersion relation there is a discussion of deviations from a linear relationship attributable to the presence of nonlinear harmonics of the main energy-carrying spectral components in the wave field. Among the findings were the following. In a detailed analysis of the high-frequency part of the wave spectrum (equilibrium interval) it is necessary to take into account the influence of a drift current. Only after correction of the spectra with allowance for the Doppler effect do the spectra acquire a universal form. The functions of the angular distribution of energy for conditions of a stable wind have a unimodal form and the position of the maxima coincides with the wind direction. The position of the maxima of the frequency - wave number spectra satisfies a linear dispersion relation in the frequency region $f_m \leqslant f < 2f_m$. However, for frequencies $f \geqslant 2f_m$ there are deviations from the dispersion curve which exceed the nonlinear effects following from potential theory. A possible explanation of the relatively great contribution of the harmonics in the region of dual frequencies of energy-carrying waves can be found in a substantial nonpotentiality of wave movement for conditions of well-developed wind waves. Figures 7; references 19: 6 Russian, 13 Western.
[152-5303]

EFFECT OF SEA WATER SCATTERING INDICATRIX ON NONSTATIONARY LIGHT FIELD

Moscow OKEANOLOGIYA in Russian Vol 19, No 6, 1979 pp 965-972

[Article by A. M. Gurfink, All-Union Machine Building Correspondence Institute, "Effect of Shape of Scattering Indicatrix of Sea Water on Nonstationary Light Field"]

[Abstract] Although the influence of the shape of the scattering indicatrix on different characteristics of the nonstationary light field (NLF) in the ocean has been investigated by many authors, they have taken into account for the most part only single scattering or asymptotic behavior. In this paper the author therefore presents the results of numerical

experiments carried out for the purpose of clarifying the influence of the shape of real hydrooptical scattering indicatrices on the NLF intensity in the intermediate region when the contributions of photons of low-order scattering and photons experiencing multiple scattering in the medium are important. The Monte Carlo method is used in computing the Green's functions for an infinitely narrow source - point receiver with a small angular aperture in a homogeneous turbid medium. The dependence of Green's functions on the shape of the scattering indicatrix was investigated and it was found that this dependence can be represented as a function of the second moment of the indicatrix $(\overline{\gamma^2})$. It was found that the behavior of the Green's function curves in those situations when the receiver is oriented into the upper hemisphere of the space will be dependent on the mean square of the scattering indicatrix angle. The dependence is almost linear for $\overline{\gamma^2} > 0.25$, and for $\overline{\gamma^2} < 0.25$ is nonlinear. The value of the logarithm for the signal maximum rapidly tends to zero and the displacements of the maximum tend to infinity. This means that in order to take into account the influence of the shape of the scattering indicatrix in a case $\overline{\gamma^2} < 0.25$ it is insufficient to know the first two angular moments of the indicatrix. The Green's function curves react sensitively to the geometry of the experiment. The relationship of the contributions of multiply scattered light and photons experiencing low-order scattering can be judged from the shift of the Green's function maximum. Figures 4, tables 1; references: 12 Russian.
[179-5303]

ELECTROMAGNETIC FIELDS OF SHORT-PERIOD WAVES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19, No 6, 1979 pp 1081-1085

[Article by V. N. Savchenko and V. P. Smagin, Far Eastern State University, "Electromagnetic Fields of Short-Period Waves in Two-Layer Sea of a Finite Depth"]

[Abstract] The authors have solved the problem of electromagnetic fields, electric currents and electropotentials of sea wind waves with a finite crest length, induced in the geomagnetic field, in seas of a definite depth, with a distribution of conductivity with depth of the type found in northern and southern seas. With respect to seas of the southern type (two-layer model) it was found that induced electric and magnetic fields and electric currents are easily determined from the known potential value. The components of the vector of electric current density are found from the known components of the electric field, using Ohm's law. Expressions are derived for the vertical component of the induced magnetic field in the surface layer of the sea medium. It was possible to compute the following electromagnetic parameters in the sea medium as a function of depth: potential, vertical component of the electric field, components

of the magnetic induction field, vertical component B_z. In a single-layer model the potential slightly exceeds the potential of a two-layer model. The potential in a two-layer model decreases more rapidly and more appreciably near the surface. With a decrease in wavelength the attenuation of the induced fields increases with depth and therefore the deep layer exerts virtually no influence on the behavior of induced fields and potential in the surface layer. In the investigated range of wavelengths it is easy to trace a proportionality between potential and wavelength. Figures 4; references 7: 5 Russian, 2 Western.
[124-5303]

FLUCTUATIONS OF SCATTERING AND ATTENUATION OF LIGHT IN SEA WATER

Moscow OKEANOLOGIYA in Russian Vol 19, No 6, 1979 pp 1021-1026

[Article by V. I. Burenkov, B. F. Kel'balikhanov and L. A. Stefantsev, Institute of Oceanology, "Some Results of Experimental Investigations of Fluctuations of the Indices of Scattering and Attenuation of Light by Sea Water"]

[Abstract] In an earlier study (OKEANOLOGIYA, 19, No 5, 1979) the authors formulated a model of fluctuations of the indices of scattering and attenuation of light by sea water and defined the requirements on the apparatus for the differential measurement of the statistical (Poisson) and turbulence-induced fluctuations. In this experimental study the Poisson fluctuations were measured using a small-angle submergible "Poseydon" scattering instrument. The scattering volume $V \sim 0.3$ cm^3, the scattering angles fall in the range from 38' to 9° and the light source is a helium-neon laser. The fluctuations caused by turbulence were investigated using a "Kvant" universal hydrophotometer developed at the Physics Institute Belorussian Academy of Sciences. The "Kvant" is a submergible instrument for measuring the attenuation and scattering indices in a cone with an aperture angle 6° to depths $\sim$ 300 m; the scattering volume $V \sim 20$ cm^3. All the measured characteristics were registered parallely with a seven-channel magnetic recorder and auxiliary recorders. The experimental data are analyzed in detail. These results confirm the correctness of the formulated model, but both the theoretical and experimental studies are but a first step in this direction. It has only been possible to isolate the principal factors determining the fluctuations of the primary hydrooptical characteristics and estimate the relative contribution of the fluctuations caused by these factors.
[179-5303]

HOLOGRAPHIC METHODS FOR MARINE GEOPHYSICAL RESEARCH TESTED

Moscow PRAVDA in Russian 25 Nov 79 p 6

[Article by A. Androshin: "On the Screen -- the Sea Floor"]

[Abstract] The first laboratory of marine geophysical holography has been established in the Southern Division of the Institute of Oceanology. The director of this laboratory is Candidate of Technical Sciences Oleg Aleksandrovich Vorob'yev. He points out that when using traditional seismic prospecting methods at sea so much data is collected that countless computation centers are required for its processing. However, the holography principle considerably simplifies this time-consuming process. The principle lies at the basis of instrumentation transforming seismograms into graphic images of sections of the earth's crust. This results in a reduction in the time required for seeking and exploring new mineral deposits. The load on computation centers is lessened, and computers can be switched to solution of other economic and scientific problems. It has been decided that seismic holography is effective for geological work at sea. A research vessel tows apparatus for transmission and reception of seismic signals. Passing through rock layers, the signals are returned to the shipboard holographic complex. A graphic image of the sea floor section appears on the screen of a color television set. The geological object image can be used in evaluating the nature of the underwater rocks, their physical properties and bedding conditions. It is hoped that seismic holography methods will help in considerably accelerating the processing of data and the process of search for underwater deposits.
[166-5303]

WIND EFFECT ON LARGE-SCALE OCEAN CURRENTS

Moscow IZVESTIYA AKADEMII NAUK, FIZIKA ATMOSFERY I OKEANA in Russian Vol 15, No 12, 1979 pp 1300-1306

[Article by V. P. Kochergin and A. V. Shcherbakov, Computation Center, Siberian Division USSR Academy of Sciences, "Wind Effect on Large-Scale Ocean Currents"]

[Abstract] A study was made of the influence of wind stress on the process of formation of the large-scale density field in the North Atlantic. Three numerical experiments were carried out with the same initial density field and with identical physical parameters. In the first variant the source of movement was the density flux and wind stress. In the second variant the ocean currents were caused by the density flux and wind was not taken into account. In the third variant the wind effect was taken into account, but the density flux was not. An equation for density with zero fluxes on a

solid lateral surface is derived and is solved by the method of a series of embedded meshes. Using this approach, the results of the mentioned numerical experiments show that the wind exerts a significant influence on formation of the subtropical density minimum in the layer from 300 to 1000 m. It is shown that an increase in the values of the coefficients of turbulent diffusion and the use of a density which is stipulated on the entire boundary of the ocean considerably decrease this effect. The materials presented in this paper make it clear that the wind exerts a significant influence on formation of the subtropical density minimum and on anticyclonic circulation in the subtropics. Figures 6; references 11: 10 Russian, 1 Western.
[151-5303]

PROPAGATION OF SHOT WAVES IN STRATIFIED OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 15, No 12, 1979 pp 1307-1315

[Article by Yu. V. Petukhov and V. Ye. Fridman, Gor'kiy Radiophysics Scientific Research Institute, "Propagation of Shot Waves in a Stratified Ocean"]

[Abstract] This is essentially a continuation of an earlier study (Ye. N. Pelinovskiy, et al., "Approximate Equations for the Propagation of Powerful Acoustic Signals in the Ocean," IZV. AN SSSR, FAO, 15, No 1, 1979). In this new investigation the authors have derived analytical expressions for the amplitude, time constant and energy of the acoustic wave resulting from shots in an ocean with an arbitrary hydrology. These expressions then made it possible to analyze the joint effect of the nonlinearity of the signal and inhomogeneity of the ocean. Simple expressions are also derived for the case of a plane-layered ocean medium, and these are employed in calculating all the parameters of a shot wave, taking into account the hydrology of a specific sector of the ocean and detonation depth. It is shown that the influence of ocean stratification can lead to a slowing of nonlinear distortions of the wave, but also their acceleration. In certain cases with a sufficiently strong divergence of the rays the development of nonlinear effects in the wave can cease. In the case of propagation of a shot wave in a linearly stratified ocean it was found that inhomogeneity can change the parameters of the shot signal by more than 10% during its vertical propagation. In the case of small glancing angles the joint influence of nonlinearity and inhomogeneity results in the parameters of the shot wave differing by several times from their values in a homogeneous ocean. Figures 5; references 12: 9 Russian, 3 Western.
[151-5303]

REMOTE INVESTIGATIONS OF INTERNAL WAVES IN OCEAN

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 249, No 4, 1978 pp 980-983

[Article by Academician Ukrainian Academy of Sciences B. A. Nelepo and Yu. M. Kuftarkov, Marine Hydrophysical Institute Ukrainian Academy of Sciences, "Experimental Investigations of Characteristics of Internal Waves in Oceans by Remote Methods"]

[Abstract] On an expedition of the 18th voyage of the scientific research ship "Akademik Vernadskiy," which carried out investigations in the North Atlantic under the international program "JASIN-78," an experiment was carried out whose objective was a determination of the interrelationship between internal waves of the seasonal thermocline and the radiation temperature of the free surface. The experiment was carried out in three variants, but the only one considered here was when the ship is at drift. The observations of the field of internal gravitational waves were made from the drifting ship using an antenna consisting of three bundles of distributed temperature sensors, spatially separated. Two bundles were lowered from the ship's stern and tank and the third was placed on a buoy at a distance of 100 m from midships, perpendicular to its side. The sensors occupied the upper quasihomogeneous layer and the seasonal thermocline. Microstructure of the temperature field was determined with a floating-up probe, directly at the free surface. The mean profile of the Brent-Väisälä frequency was determined. Measurements of the radiation temperature of the ocean surface were made using an IR radiometer with a time constant of 3 sec. It was found that fluctuations of the effective temperature in the thermocline are almost in antiphase with the radiation temperature of the free ocean surface. This gives basis for assuming that on the basis of IR photographs of the free surface it is possible not only to ascertain the scales of the internal waves, but also determine convergence and divergence zones. Figures 2, tables 1; references 8: 5 Russian, 3 Western.
[116]

CORRELATION BETWEEN SMALL-SCALE TURBULENCE AND WATER STRATIFICATION

Moscow OKEANOLOGIYA in Russian Vol 19, No 6, 1979 pp 982-991

[Article by I. D. Lozovatskiy and R. V. Ozmidov, Institute of Oceanology, "Correlation Between the Characteristics of Small-Scale Turbulence and the Parameters of Water Stratification in the Ocean"]

[Abstract] On the 19th voyage of the scientific research ship "Dmitriy Mendeleyev" (autumn 1977) specialists made measurements of the microstructure of the current velocity and sea water conductivity fields in the Kuroshio zone. On the basis of the results of joint measurements of small-scale fluctuations and the mean parameters of hydrophysical fields it was

possible to determine the interrelationships between the statistical characteristics of turbulence and the local values of the Richardson number in the ocean. For example, for the normalized values of the rate of dissipation of turbulent energy $\tilde{\varepsilon}_u$ and the mean square values of velocity fluctuations s_u it was found that $\tilde{\varepsilon}_u = \varepsilon_u/l^2N^3 \sim Ri^{-3/2}$, and $\tilde{s}_u = \tilde{s}_u/lN \sim Ri^{-1/2}$ (where N is the Väisälä frequency and l is the local external turbulence scale). In the dependence of the ratio of the coefficients of turbulent exchange $\alpha = K_T/K_u$ on Ri it is possible to discriminate two sectors: when $Ri \lesssim 0.1$ $\alpha \sim Ri^{-1/2}$, but with $Ri \gtrsim 0.1$ $\alpha \sim Ri^{-1}$. The dependence of the ratio of the rate of entrainment to friction velocity u_e/u_* in the internal layers in the ocean is described satisfactorily by the expression $u_e/u_* \sim Ri_*^{-1}$, where Ri_* is the global Richardson number. References 16: 8 Russian, 8 Western.
[179]

RED SEA EXPEDITION TESTS "PAYSIS" MANNED SUBMERSIBLE

Moscow PRAVDA in Russian 8 Jan 80 p 6

[Article by Corresponding Member USSR Academy of Sciences A. Monin: "The 'Paysis' Goes for a Record"]

[Abstract] A Soviet oceanological expedition is working in the Red Sea. The purpose is a study of the floor of the axial valley of the Red Sea, which is a trench with very steep side walls. The expedition is made up of three ships of the Institute of Oceanology: "Akademik Kurchatov," "Professor Shtokman" and "Akvanavt." The expedition is outfitted with the usual means for geological and geophysical research, such as echo sounders, corers, dredges, underwater cameras, magnetometers, gravimeters and instruments for hydrochemical measurements. The expedition has a manned underwater vehicle called the "Paysis," capable of submerging to a depth as great as two kilometers with three aquanauts aboard. This submersible was used in investigations of the floor of Lake Baykal. In addition, the expedition has unmanned automatic vehicles towed near the bottom. The expedition prepared a detailed map of the selected rift zone which shows mountains, depressions, "pockets" with bottom sediments and magnetic field anomalies. Along the very axis of the rift valley there is a vertical wall with a height up to 500 meters, along whose foot on the west there is a narrow trench with the greatest depths -- as much as 1,800 meters. The "Paysis" has already submerged eight times. It was found that on the bottom of the rift zone there are numerous fresh submarine outpourings of basaltic (so-called pillow) lavas. In the course of one descent a record depth of 1,800 meters was attained and the vertical wall was examined. The presence of bottom crusts characterized by groups of small holes suggests the existence of hydrothermal activity in the floor of the rift valley.
[167-5303]

UPPER OCEAN LAYER AS AN ENERGY SINK FOR INTERNAL WAVES

Moscow OKEANOLOGIYA in Russian Vol 19, No 6, 1979 pp 973-981

[Article by L. A. Ostrovskiy and I. A. Soustova, Institute of Applied Geophysics, "Upper Mixed Layer of Ocean as an Energy Sink of Internal Waves"]

[Abstract] The interaction between internal waves and turbulence in the upper layer of the ocean is considered. It would seem that this thin layer should not introduce any significant contribution to the energy balance of waves, at least long waves. In this paper, however, the authors show that its influence is substantial not only because the density of turbulent energy in it is maximum, but most importantly, due to the well-expressed vertical variability in the region of the seasonal thermocline, which causes an additional expenditure of wave energy in overcoming buoyancy forces in the turbulent diffusion process. Because of this mechanism in the thermocline there is evidently a considerable current of energy of long internal waves. The article analyzes this problem within the framework of the equations of the semiempirical theory of turbulence for a stratified fluid. Using a two-layer model, it was possible to find the frequency dependence of the decrement of wave attenuation due to the mechanisms of turbulent viscosity and turbulent diffusion in the thermocline region. The diffusion mechanism predominates in the energy-carrying part of the spectrum. The wave attenuation time is slightly dependent on frequency and is several days in the entire mentioned region. It is made clear that the thermocline region can be an extremely important energy sink for wave energy. Figures 3; references 17: 12 Russian, 5 Western.
[179-5303]

METHOD FOR SOUNDING THE OCEAN FLOOR

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 5, 1979 pp 113-119

[Article by V. V. Polovinko, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Investigation of the Method of Laser Sounding of the Discontinuity of Two Media With Analogue Amplitude Modulation of Radiation in the Example of Sounding of the Ocean Floor"]

[Abstract] The methods of laser sounding of the discontinuity of two media are used in such work as mapping of ice fields, the ocean floor, measuring the parameters of wind waves. In this paper the author investigates the method of laser sounding of the discontinuity of two media with analogue amplitude modulation of laser radiation in the example of sounding of the ocean floor. A full derivation is given for the equation for laser sounding of the discontinuity of two media. This is followed by an investigation of the signal-to-noise ratio at the output of a linear system with a

frequency characteristic satisfying the equation for laser sounding of the discontinuity of two media. It is shown that an increase in the signal-to-noise ratio and accordingly, the sounding range, can be attained by an artificial attenuation of the received radiation as a function of distance. The article describes how the optical receiving system attenuates the radiation passing through the objective under the condition that the field diaphragm is smaller than the image of the bottom sector illuminated by the laser at a finite distance. The range of values of parameters of the receiving-transmitting system with which the receiving system attenuates the radiation is defined. The influence of attenuation of radiation on the signal-to-noise ratio in the considered linear system is determined. The paper therefore shows that artificial attenuation of the received radiation increases the effectiveness of the laser sounding of the discontinuity of two media. Figures 1; references 7: 4 Russian, 3 Western.
[126-5303]

CHARACTERISTICS OF SOURCES OF MICROSEISMS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI IN Russian No 11, 1979 pp 67-71

[Article by A. A. Ostrovskiy, Institute of Oceanology, "Some Characteristics of Sources of Microseisms"]

[Abstract] A brief review of the sources in the literature relating to sources of microseisms is presented. Most researchers have now concluded that microseisms originate in the coastal zone. However, there is no unanimity of opinion concerning the relative role of sea standing and travelling waves in the generation of the microseismic background. Accordingly, this paper presents data giving a comparison of the energy characteristics of these two sources of microseisms: pressure exerted by travelling waves on the shore and variable pressure on the bottom caused by standing waves on the ocean surface. The data indicate that although the pressure exerted by travelling waves on the shore is greater than the pressure of standing waves on the bottom, under definite conditions situations can arise when the source of secondary microseisms will be more intense than the source of primary microseisms. Shore parameters play a significant role: the steeper the shore, the more intense will be the generated microseisms. It must be concluded that microseisms are generated primarily by travelling waves, although it must be allowed that with special shore and meteorological conditions standing waves can generate a considerable, even the main part of the microseismic energy. Figures 1; references 20: 10 Russian, 10 Western.
[107-5303]

MODERN PROBLEMS IN GEOPHYSICAL RESEARCH IN THE OCEAN

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 4, GEOLOGIYA in Russian No 6, 1979 pp 93-100

[Article by A. V. Kalinin and A. G. Gaynanov, Geophysics Department, Moscow State University, "Problems in Three-Dimensional Geophysical Research in the Ocean"]

[Abstract] The latest problems and advances in the three-dimensional study of the world ocean are discussed. Sections of the paper deal with seismic investigations, gravimetric research, magnetometric studies and thermal measurements. It is made clear that the idea that there is an identity between the rate of carrying out reconnaissance geophysical investigations and the productivity of geophysical investigations cannot be considered correct. There must be a new approach to the task of multisided geophysical research in the world ocean in which observations at stations are becoming an indispensable part of the total geophysical complex. The combination of reconnaissance (route) and station observations will make possible a considerable increase in the information yield of geophysical investigations and increase the reliability of geological interpretation of geophysical data as a whole. The planning or implementation of geophysical investigations in the ocean should be carried out adhering to progressive stages: reconnaissance, point (at stations), polygonal. Serious attention must be devoted to the development of an instrument base for carrying out geophysical investigations with use of the entire thickness of the ocean and abyssal bottom observations. References: 7 Russian.
[144-5303]

REVIEW OF STATUS OF INVESTIGATIONS OF ATTENUATION OF WAVE MOVEMENTS

Moscow IZVESTIYA VSESOYUZNOGO GEOGRAFICHESKOGO OBSHCHESTVA in Russian Vol 111, Issue 6 (Nov-Dec), 1979 pp 507-512

[Article by B. N. Shatov, "Critical Analysis of the Status of Investigations of the Process of Attenuation of Wave Movements of a Fluid With Depth"]

[Abstract] A review of the principal experimental investigations of the process of attenuation of wave movements of a fluid with depth during the period 1947-1962 was published by V. F. Tsyplukhin in 1964 and was dealt with in the greatest detail in a monograph by B. Kh. Glukhovskiy published in 1966. But many new results have been obtained in this field in the last decade. The employment of modern computers has broadened and deepened the analysis of data from instrumental measurements of the process. Accordingly, the author here has analyzed the state of study of this process and defined directions for further research. In general, it is concluded

that this subject has been thoroughly investigated. Nevertheless, there are problems which can be solved by experimentation, such as the following: a) determination of the form of the profile of wave pressures at subsurface horizons; b) determination of the form of the distributions of ordinates of the process in the entire depth of the fluid; c) obtaining an approximation of the distribution of heights and periods of the profiles of vertical wave movements; d) analysis of the statistical properties of the process of attenuation of wave movements of the fluid with depth, taking the group structure of waves into account. References 42: 33 Russian, 9 Western.
[163-5303]

RESEARCH SHIPS TO STUDY RED SEA USING MANNED SUBMERSIBLES

Moscow PRAVDA in Russian 8 December 79 p 2

[Text] The "Akademik Kurchatov," a scientific research ship of the Institute of Oceanology, has left Kaliningrad to cruise to the coast of the Arabian Peninsula. Together with two other ships, the "Professor Shtokman" and "Akvanavt," it will conduct studies of the seabed in the Red Sea reef zone.

The task of this geological-geophysical expedition, as reported by A. S. Monin, Corresponding Member USSR Academy of Sciences, is to find evidence of the processes of rock salt layer drifting. A specially designed submersible, the "Pisces," will enable scientists to probe great depths. It is equipped with numerous instruments for measuring current velocities, salinity and content of dissolved oxygen, as well as a "hydraulic arm" that can take samples and perform other operations on the seabed.
[119-P]

III. TERRESTRIAL GEOPHYSICS

CORRELATION BETWEEN SEISMICITY AND SOLAR ACTIVITY

Tashkent UZBEKSKIY GEOLOGICHESKIY ZHURNAL in Russian No 4, 1979 pp 6-9

[Article by K. N. Abdullabekov, Seismology Institute Academy of Sciences Uzbek SSR, "Correlation Between Seismicity of the Kopetdag, Pamir-Tien Shan and Caucasus and Solar Activity"]

[Abstract] A study was made of the correlation between the seismicity of the Kopet-Dag, Pamir-Tien-Shan and Caucasus and solar activity. The basis for the study was a catalogue of strong earthquakes in the eastern part of Central Asia and Kazakhstan, Western Turkmenia and the Caucasus and a curve of solar activity, expressed in Wolf numbers. It was found that in the Caucasus and in eastern Central Asia the release of seismic energy occurs independently of solar activity. Strong earthquakes are observed in the years of the minimum and maximum of solar activity, and also in the interval between the extrema. Strong earthquakes in the Kopet-Dag are associated primarily with years of maximum solar activity. The total seismic energy for the eastern part of Central Asia and the Caucasus within the 11-year solar activity cycle is almost at the same level: for eastern Central Asia — within the range 10^{16}-$10^{17.5}$ J and in the Caucasus 10^{14}-$10^{15.5}$ J. The energy release in the Kopet-Dag region differs from the others and varies in dependence on the 11-year solar activity cycle. In years of the minimum the total annual energy release is $10^{13.3}$-$10^{13.5}$ J, whereas in years of the maximum it increases to 10^{16} J or more. The maximum energy release is in the interval 1 - +2 years from the solar activity maximum. This coincidence of the release of seismic energy in the Kopet-Dag with solar activity is evidence that in this region solar activity plays the role of a triggering mechanism. Thus, the earthquakes of the Caucasus and eastern Central Asia occur independently of the 11-year solar cycle, whereas the Kopet-Dag earthquakes are associated with the years of the solar activity maximum. Two destructive earthquakes have occurred in Iran (late 1978 and early 1979) in this epoch of onset of the next solar activity maximum; there is a high probability of the occurrence of such tremors in the territory of western Turkmenia. Figures 3; references 5: 3 Russian, 2 Western.
[94-5303]

THERMAL CONVECTION IN THE EARTH'S UPPER MANTLE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 10, 1979 pp 3-13

[Article by V. P. Turbitsyn, P. P. Vasil'yev and A. A. Karasev, Institute of Physics of the Earth, "Thermal Convection in the Earth's Upple Mantle"]

[Abstract] A quantitative investigation was made to determine thermal convection in the earth's upper mantle. The authors numerically solve the nonlinear convection equations in a model of a plane layer with constant parameters, averaged for the upper mantle using different possible mean fixed temperature drops in the layer. The objective of the study was a numerical solution of the equations for different convection models in the earth and obtaining tabulated values of the velocity and temperature fields in the upper mantle. It was found that the mean adiabatic temperature gradient in the upper mantle is 0.44 degree$\cdot$km^{-1}, which for a layer with a thickness $H = 700$ km gives a temperature drop $\simeq 300°$. Assuming the real temperature drops in this layer of the mantle to be 700°, for the superadiabatic drop one obtains $\delta T = T'' - T' \simeq 400°$. Allowing an inaccuracy in the knowledge of these temperatures of ±150°, it is found that the drop in superadiabatic temperatures in the upper mantle falls in the range $100° < \delta T < 700°$. Table 1 gives the distribution of superadiabatic temperatures within a convective cell in the upper mantle for $\delta T = 100°$ and $\delta T = 700°$; Table 2 gives the distribution of velocities in a convective cell for $\delta T = 100°$; Table 3 gives the same data as in Table 2, but for $\delta T = 700°$. It is assumed that the most probable real value δT for the upper mantle is $\delta T = 400°$, which corresponds to well-developed convection. The computed stationary fields of convective velocities and temperatures in the upper mantle can be used in quantitative determinations of nonuniformity of convective heat flows and also irregularities of relief and gravitational anomalies arising during convection. Figures 2, tables 3; references 10: 6 Russian, 4 Western.
[106]

EFFECT OF SLANT DISCONTINUITY ON BEHAVIOR OF RAYLEIGH WAVES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 10, 1979 pp 58-66

[Article by A. I. Lutikov, Institute of Oceanology, "Effect of a Slant Discontinuity on the Reflection and Refraction of Rayleigh Waves"]

[Abstract] The author studied the influence of a slant discontinuity between two blocks of matter with different elastic parameters on the reflection and transmission of Rayleigh waves. The article can be regarded as a further development and generalization of the author's previous work (IZV. AN SSSR, FIZIKA ZEMLI, No 4, 1978). In that study the author determined the coefficient of transmission of a Rayleigh wave through the vertical contact

of two media. The problem of a "vertical contact" was also studied by Its and Yanovskaya (VYCHISLITEL'NAYA SEYSMOLOGIYA, No 10, Moscow, 1977). The accuracy of their approximate solution is greater than that obtained by the author in his first study, but the author's solution requires a far lesser volume of computations and immediately makes it possible to obtain rough estimates of the transmission coefficient in the case of poorly defined contrasts of the contacting media. Later Its and Yanovskaya (IZV. AN SSSR, FIZIKA ZEMLI, No 6, 1979) examined the case of slant incidence of surface waves on a vertical discontinuity of media and obtained expressions for the reflection and transmission coefficients. In the solution proposed here, as in the author's earlier study, use is made of the Green's functions method but due to the more correct choice of the form of the Green's function the approximate solution obtained has the same order of accuracy as the solution obtained by Its and Yanovskaya. The case of a vertical discontinuity can be obtained from the proposed solution if the slope of the discontinuity is assumed equal to zero. A solution is given for the contact of two uniform quarter-spaces because the object is to study the effect caused by the slope of the discontinuity. However, if the Green's function is used for a multilayer half-space the solution can also be generalized for the case of the contact of multilayer quarter-spaces. Figures 3; references 8: 6 Russian, 2 Western.
[106]

DEEP STRUCTURE OF THE OCEAN FLOOR

Moscow SOVETSKAYA GEOLOGIYA in Russian No 11, 1979 pp 30-42

[Article by N. K. Bulin, All-Union Scientific Research Geological Institute, "Deep Structure of the Ocean Floor"]

[Abstract] Geological and geophysical data on the composition and structure of the earth's crust in the world ocean are examined. In the basement of the oceans there is extensive development of magmatic and metamorphic rocks of acidic composition, including rocks of the granulite facies. The so-called oceanic layer may consist not of basic rocks ("basalt"), but of more acidic varieties and constitute a "granite" or "diorite" layer. The outlines of a new seismic model of the ocean crust are proposed. In this model the thickness of the solid crust in the ocean attains 35-55 km; the Mohorovicic discontinuity is situated considerably deeper than the bottom of the third oceanic layer. The bottom of the third layer, now assumed to be the Mohorovicic discontinuity, is a thin (1-2 km) layer below which there are rocks with $v_p \approx 6.5$-7 km/sec. Data are presented indicating a fundamental similarity of the composition and structure of the lithosphere of the continents and oceans. Available factual materials on the structure of the earth's crust and the top of the mantle give no basis for discriminating a special "oceanic" type of lithospheric crust. Figures 2; references 17: 15 Russian, 2 Western.
[147-5303]

COMBINED ELECTRIC PROSPECTING AND GRAVIMETRIC WORK

Moscow SOVETSKAYA GEOLOGIYA in Russian No 11, 1979 pp 110-118

[Article by V. V. Arshinov, A. N. Boguslavskiy, Yu. S. Korol'kov and O. A. Potapov, Scientific-Production Combine "Soyuzgeofizika," "Results of Electric Prospecting and Gravimetric Work in the Caspian Depression"]

[Abstract] Since 1975 the "Soyuzgeofizika" Combine has carried out combined geophysical investigations by the method of sounding with an artificially created electromagnetic field and gravimetry for the purpose of a direct search for petroleum and gas in the zone of joining of the Caspian depression and the South Emba Paleozoic uplift. The work was carried out in a system of submeridional profiles passing through the Tortayskaya and Turesayskaya structures. The area covered was about 1,000 km^2. Joint use of the methods made it possible to compile a schematic map of tectonic dislocations (Fig. 1) and cartographically represent the overall results of the investigations (Fig. 2). The collected data made it possible to draw conclusions concerning the presence of deposits of hydrocarbons. The combined use of these two methods is of great effectiveness in the solution of specific petroleum reconnaissance problems in the region of the southern margin of the Caspian depression. In addition, the use of electric prospecting and gravimetry makes it possible to reduce the volume of expensive work by drilling and the common deep point method. Figures 2, Tables 4; references: 17 Russian.
[147-5303]

USE OF ELECTROMAGNETIC FIELDS IN PREDICTING EARTHQUAKES

Tashkent UZBEKSKIY GEOLOGICHESKIY ZHURNAL in Russian No 5, 1979 pp 11-15

[Article by G. A. Mavlyanov, V. I. Ulomov, K. N. Abdullabekov and S. S. Khusamiddinov, Seismology Institute Uzbek Academy of Sciences, "Investigations of Variations of the Parameters of Natural Electromagnetic Waves for the Purpose of Predicting Earthquakes"]

[Abstract] In order to investigate electromagnetic radiations of the earth's crust for the purpose of predicting strong earthquakes a special apparatus was constructed for making stationary observations at a number of stations and a mobile variant was used in making observations directly in earthquake epicentral zones. It was found that the characteristic time of anomalous changes before earthquakes is dependent on the energy class of the earthquake. Anomalous parameters are unrelated to other geophysical phenomena, such as magnetic storms, ionospheric disturbances and meteorological phenomena. In the case of close earthquakes there is characteristically a distortion of the diurnal variation and an increase in the amplitude of field intensity, whereas in the case of distant earthquakes the form of

the diurnal regular variation may not be impaired and the appearance of the anomaly in this case is manifested in an increase in the amplitude of the diurnal variation during both nighttime and daytime, being greater at night. The data presented in this paper indicate that there is an unquestionable relationship between anomalies of the natural electromagnetic field and seismic events. Accordingly, it is possible to predict earthquakes on the basis of the anomalous variations of the electromagnetic field. The period of the "alarm level" is dependent on the energy of the anticipated earthquake -- it is from one week for K = 15-17 to several hours for K = 11-12. The noted effects make it possible to predict only the time of an event. A prediction of place requires a knowledge of the spatial extent of anomalous regions and a denser network of observations. Figures 4; references 7: 6 Russian, 1 Western.
[105]

CHARACTERISTICS OF ARCHES IN LAYERS ABOVE AND BELOW SALT STRUCTURES

Tashkent UZBEKSKIY GEOLOGICHESKIY ZHURNAL in Russian No 5, 1979 pp 55-58

[Article by U. S. Umarkhodzhayev, Institute of Geology and Geophysics Uzbek Academy of Sciences, "Displacement of Arches of Structures Above and Below Salt in the Gadzhak-Bayangorskiy Region and its Importance for Planning Structural Reconnaissance Work and Parametric Drilling in the Surkhandar'inskaya Depression"]

[Abstract] The considered region is situated in the southeastern part of the Baysunskaya syncline and takes in the area of the Gadzhakskaya and Bayangorskaya anticlines. Sixteen exploratory and two structural-parametric holes have now been drilled in the described region. The structures above the salt are complexly dislocated and are represented by different structural forms. They are complicated by dislocations, primarily upthrusts and overthrusts. Beneath the salt the plicative dislocations are slightly bent, complicated by faults of the upthrust type. In the subsalt horizons the clearly expressed structures of the deposits above the salt correspond to a monoclinal bedding of the strata or a syncline. It is recommended that the search for local anticlinal traps be carried out to the northwest and west, 5-7 km from the arch of the folds above the salt. However, if the deposits above the salt are complicated by upthrusts or overthrusts, the displacement of the arches of folds above the salt is somewhat less (2-3 km). This noncorrespondence between structural forms and displacement of the arches of structures above and below the salt must be taken into account in the search for local structures in the subsalt deposits. This has made it possible to discriminate several regions and areas favorable for the detection of local structures associated with subsalt deposits. Figures 2; references: 3 Russian.
[105-5303]

SEISMOTECTONIC DEFORMATION OF GARM REGION

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 10, 1979 pp 24-53

[Article by A. A. Lukk and S. L. Yunga, Institute of Physics of the Earth, "Seismotectonic Deformation in the Garm Region"]

[Abstract] A study was made of the seismotectonic deformation of the Garm region in Tadzhikskaya SSR on the basis of 2,250 determinations of the mechanisms operative at the foci of weak ($M<4$) surface earthquakes during the period from 1964 through 1976. The velocity tensor of seismotectonic deformation is represented with an accuracy to a constant factor as the product of the direction tensor, corresponding to the mean mechanism, and the sum of the seismic moments of the earthquakes. Centers of deformation with linear dimensions 20-30 km, stable in time, are defined. The authors discuss the general pattern of seismotectonic deformation of the region and present qualitative hypotheses concerning the causes of this process. A comparison of vertical seismotectonic and tectonic movements is given. The position of strong earthquakes against a background of seismotectonic deformation is considered. The article is accompanied by a map of the Garm region with respect to its deformed state; this is in satisfactory agreement with the principal geological structures and concepts relating to vertical tectonic movements during the Quaternary. A qualitative model satisfactorily describing the observed deformed state is formulated. Figures 6, tables 4; references 50: 36 Russian, 14 Western.
[106-5303]

MECHANISM OF DEFORMATION OF SEISMICALLY ACTIVE CRUSTAL VOLUME

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 10, 1979 pp 14-23

[Article by S. L. Yunga, Institute of Physics of the Earth, "Mechanism of Deformation of a Seismically Active Crustal Volume"]

[Abstract] The theoretical-methodological problems involved in an analysis of seismotectonic deformations are examined. The authors propose a formalization of the concept "mean earthquake mechanism." The velocity tensor of seismotectonic deformations is represented as the product of the direction tensor corresponding to the mean mechanism and the sum of the seismic moments of earthquakes normalized for time, volume and shear modulus. The paper presents the results of computations of seismotectonic deformations for rock strata in Petr I Range, situated in the Garm region in the transition area from the Pamir to the Tien Shan. The possibility of employing the inconsistency test to seismotectonic deformations for the purposes of long-range forecasting of strong earthquakes is discussed. The

earthquake data for the Garm region show that the seismotectonic deformations of rocks in Petr I Range have a well-expressed stable direction. This made it possible to compute the principal directions of the tensor of the rate of seismotectonic deformations and the maximum rates of seismotectonic deformations. Figures 2, Tables 1; references 34: 27 Russian, 7 Western.
[106-5303]

PARAMETERS OF ACTIVITY OF WEAK CRUSTAL EARTHQUAKES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 12, 1979 pp 23-35

[Article by Yu. M. Teytel'baum and V. S. Ponomarev, Institute of Physics of the Earth, "Variations in the Activity of Weak Crustal Earthquakes With Different Focal Depths"]

[Abstract] On the basis of data on the seismicity of Garm region in Tadzhiksaya SSR the authors have made a detailed study of the temporal changes in the activity of weak ($K \geqslant 7$) crustal earthquakes with different focal depths. It was found that the course of temporal changes in different layers is substantially different. Near-surface earthquakes, constituting about 85% of the total number of earthquakes, determine the differences in the regime in individual parts of the region. The regime of relatively deep earthquakes (deeper than 10 km) is uniform over the entire area of the region. The temporal changes in activity of deeper earthquakes reveal a close correlation with the development of strong earthquakes ($K = 13$-14). This is manifested in brief increases in the activity level in the entire area of the region 1 1/2 years before the appearance of a strong earthquake. Long-term tendencies in the change in the activity level of deeper earthquakes can be used for long-term evaluations of the overall change in seismic danger over the area of the region. Figures 8, tables 5; references 11: 10 Russian, 1 Western.
[153]

METHODS FOR STUDYING DEEP STRUCTURE OF THE UPPER CRUSTAL LAYERS

Moscow SOVETSKAYA GEOLOGIYA in Russian No 10, 1979 pp 63-75

[Article by N. K. Klyuyev, All-Union Scientific Research Geological Institute, "Methods for Studying the Deep Structure of the Upper Part of the Earth's Crust"]

[Abstract] In the example of the region of joining of the Tokrauskaya and Zhaman-Sarysuyskaya structural-formation zones a detailed study was made of the sequence for investigating the deep structure of that part of the earth's crust over the "basalt" layer. It was possible to discriminate

three principal stages in such an investigation. In the first stage it is necessary to determine the principal global characteristics of the potential physical fields with their mandatory tie-in to deep seismic sounding data. In the second stage there is a joint analysis of geological, geophysical, petrophysical and other investigations for the purpose of determining the nature of the observed anomalies and their subsequent separation. In the third stage provision is made for a search for an optimum model on the basis of a complex of geological-geophysical investigations. The investigations described in this paper confirm that the principal discontinuities in the earth's crust and the bottom of the crust constitute real discontinuities in the majority of cases; these discontinuities separate layers consisting of rocks of different chemical and petrophysical composition. There is a good convergence of the results of interpretation of geophysical data and drilling data. Figures 3, tables 1; references: 18 Russian.
[146]

TECTONOMAGNETIC INVESTIGATIONS IN POLYGONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 249, No 2, 1979 pp 326-328

[Article by Academician M. A. Sadovskiy, S. Kh. Negmatullayev, I. L. Nersesov and Yu. P. Skovorodkin, Institute of Physics of the Earth, "Tectonomagnetic Investigations in the Dushanbe and Garm Polygons"]

[Abstract] Personnel of the Institute of Physics of the Earth and the Institute of Seismic Resistant Construction and Seismology of the Academy of Sciences Tadzhik SSR in the seismoactive zone of joining of the Pamir and Tien Shan are carrying out long-term continuous and discrete measurements of the modulus of the geomagnetic field vector (T) using proton magnetometers. It was discovered that there are changes in the local geomagnetic field with a duration from several weeks to several months in the form of either baylike disturbances or a directed change with a subsequent relatively rapid restoration of the initial level. During the observation period 1976-1978 in 60% of the cases of occurrence of local earthquakes of the energy class $10 < K < 13$ ($K = \lg E$, J) there was found to be a spatial-temporal correlation with such variations. The moments of occurrence of local earthquakes occur during periods of restoration of the initial level or at the extrema of time series ΔT. In addition to local geomagnetic variations arising before local earthquakes ($3.3 < M < 5.2$) there were field changes preceding strong earthquakes whose epicenters were situated outside the region of investigations. The hypocenters of all these earthquakes were situated at depths from 5 to 45 km. As a result it was possible to investigate the correlation between the magnitude of crustal earthquakes in the region and the distance to the point most distant from the epicenter at which the variation was observed. It was found that the dependence between the distance to the epicenter and magnitude is close to linear (linear correlation coefficient 0.86). The maximum variations were

registered at points situated at different distances from the epicenters. But the intensity of the variations has little dependence on earthquake energy, at least in the interval $3.3 < M < 6.8$. On the basis of magnetic data it can be concluded that earthquake energy to a high degree is related to the extent of the developing zone of accumulation and release of elastic stresses, to a greater extent than the magnitude of the accumulated stresses in the volumes surrounding the focal zone of an impending earthquake. Figures 3; references: 3 Russian.
[123]

MULTIPARAMETER METHOD IN DIRECT SEARCH FOR PETROLEUM AND GAS

Dushanbe DOKLADY NAUK TADZHIKSKOY SSR in Russian Vol 22, No 6, 1979 pp 354-358

[Article by B. N. Don, A. T. Durkin, A. M. Zhukov, S. M. Ramazanova and B. A. Serdiy, Geology Administration Tadzhik SSR, Southern Geophysical Expedition and Moscow Institute of the Petrochemical and Gas Industry, "Use of a Multiparameter Method in Direct Search for Petroleum and Gas Deposits in Southern Tadzhikistan"]

[Abstract] The application of the multiparameter method in direct search for petroleum and gas deposits in southern Tadzhikistan is discussed. Using correlation functions it is possible to find the values of a number of parameters of the seismic record: apparent period of the autocorrelation function (ACF), ratio of the maxima of the autocorrelation functions, correlation shift between traces, correlation coefficient of traces, etc. Using the difference in the periods of the autocorrelation functions for two adjacent time intervals on the record it is possible to determine the parameter β characterizing the relative change in the apparent periods of the autocorrelation coefficients. Using the ACF maxima it is possible to estimate the absorption decrement δ. The β and δ parameters qualitatively characterize the absorption appearing in the change in the frequency makeup of seismic waves. The change in the correlation shifts between traces characterizes the change in effective velocity, and the change in the correlation coefficients of the traces characterizes the quality of the record. The article describes application of this complex of methods in the Kichik-Urtaboz area in the central part of the Vakhshskaya valley. In this area seismic investigations were completed for a detailed study of folds in the Paleogene and Upper Cretaceous deposits and structures had been readied for deep exploratory drilling. On the basis of drilling and seismic prospecting data it was determined that promising petroleum and gas deposits of the Bukhara layers of the Paleogene and Cretaceous are in a position structurally favorable for the accumulation of fluids. The analysis revealed the presence of an absorption anomaly which can be caused by the presence of a deposit of hydrocarbons. The data, while not unambiguous, suggest that the area is well worth further exploration. Figures 2; references: 4 Russian.
[92]

METHOD FOR ANALYSIS OF GEOMAGNETIC FIELD TIME SERIES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19, No 6, 1979 pp 1091-1096

[Article by N. M. Rotanova, N. Ye. Papitashvili and A. N. Pushkov, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Spectral Analysis of Geomagnetic Field Time Series by the Maximum Entropy Method"]

[Abstract] The maximum entropy method is now used extensively for the spectral analysis of geophysical phenomena. The method makes it possible to detect latent periodicities and evaluate their frequencies most precisely and accordingly is far superior to ordinary spectral methods. For this reason the authors have employed the method applicable to analysis of geomagnetic time series. The following aspects of this problem are considered in detail: influence of filter length or order of autoregression on position of spectral peaks; influence of degree of polynomial used for excluding trend on the spectral representation of remanent fields of geomagnetic field; spectral analysis of dynamic 100-year geomagnetic field time series. The study was made using data for Hartland observatory for the 100-year periods beginning in 1855, 1865 and 1875. It was found that the shifting of the characteristic spectral lines for the three series is noted for the most part in the low-frequency part of the spectrum. In the part of the spectrum up to 10-13 years virtually no displacements are observed. The study indicates that the maximum entropy method makes it possible to obtain the most correct evaluations of the characteristic periods in the analysis of the complex structure of temporal variations of the geomagnetic field. The method can be regarded as the optimum method for the analysis of relatively short series of observatory observations, making possible a correct comparison of spectral analysis data for different observatories and to identify individual peculiarities in the spectrum with errors not greater than five years for the low-frequency part (60-year variations) and substantially less for the high-frequency part (11 years and shorter). Figures 4, tables 1; references 15: 4 Russian, 11 Western.
[124-5303]

GEOMAGNETIC VARIATIONS AS EARTHQUAKE PRECURSORS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19, No 6, 1979 pp 1126-1128

[Article by M. I. Finkel'shteyn and N. Sh. Kambarov, Seismology Institute Kazakh Academy of Sciences, "Study of Geomagnetic Variations as Earthquake Precursors"]

[Abstract] In this investigation of the possibility of using geomagnetic variations as a predictor of earthquakes the authors have made a comparison of data on geomagnetic variations during the period of aftershocks

of the Sarykamyshskoye earthquake (magnitude 6.8) and the theoretically expected geomagnetic effects. The possible magnitude of seismomagnetic effects was ascertained. The presented data show that even in the case of increased magnetic susceptibility values for rocks and their changes under the influence of stresses in the earth's crust up to 30% the magnetic effect from earthquakes similar to the Sarykamyshskoye earthquake became small and commensurable with interference at a distance of 40-50 km. The probability of detecting seismomagnetic effects increases considerably if the experimental observations are made in the pleistoseist zone. Synchronous measurements of the variations δZ, δH and δD at points situated at distances 120, 140 and 200 km from the focus were used for an analysis of experimental magnetovariation observations during the aftershock period. At these three stations the anomalous vectors were constructed on the basis of mean hourly tables of elements of the geomagnetic field Z, H and D; the dynamics of these vectors was analyzed for June 1970. During the actual release of seismic energy there was a definite rotation of the vector, but the same phenomenon is observed before and after the event. Accordingly, there is no basis for assuming that the observed dynamics of the H vectors is due to the release of tectonic stresses in an earthquake. Analysis of the model and experimentally observed anomalous fields caused by tectonoeffects indicates that when discriminating the latter a significant role can be played by interference and the interference can be mistaken for the sought-for effect. In order to clarify the nature of the observable magnetovariation anomalous fields there must be synchronous measurements with a sufficient time series of observations at each point. Since anomalies of secular variation (long-period spectrum) and anomalous geomagnetic variations (short-period spectrum) have a different nature and dynamics, a different method must be used for studies of these variations. Figures 2; references 9 Russian.
[124-5303]

NEW TECTONIC MAPS AND DESCRIPTIONS OF SIBERIA

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 10, 1979 pp 84-87

[Article by Professor K. V. Bogolepov, "New System of Tectonic Constructions for the Territory of Siberia"]

[Abstract] On the initiative of scientists at the Institute of Geology and Geophysics Siberian Department USSR Academy of Sciences major interdepartmental work began in 1978 on compilation of the ATLAS TEKTONICHESKIKH KART I OPORNYKH PROFILEY SIBIRI (Atlas of Tectonic Maps and Reference Profiles of Siberia). The objective in compiling the atlas is the creation of the first three-dimensional model of the present-day structure of the earth's crust in Siberia. This work involves synthesis of data on the

mineralogical composition, structure, age of geological bodies making up the surface parts of the earth's crust and their geophysical parameters; systematization of knowledge concerning the deep geological structure of the earth's crust and determination of bedding conditions with depth for geological bodies discriminated at the surface and hidden beneath it; clarification of the spatial and genetic relationships in the development of geostructural regions in the course of individual tectonic epochs, that is, analysis of lateral series of simultaneously forming structural elements; determination of the general patterns of formation and evolution of the earth's crust in Siberia, its mineralogical composition and structure. The work program for the atlas provides for the compilation of 11 maps with tectonic and geophysical content, including individual tectonic maps for megacomplexes. In addition, there will be an overall tectonic map for the entire system of megacomplexes, a map of surface relief of the folded basement of platform regions, a map of deep structure of the earth's crust and upper mantle, a map of the present state of the earth's crust (stresses, heat flows, seismicity, recent movements) and also a series of reference geological-geophysical profiles intersecting the main geostructural regions of Siberia. The detection of new and extremely important patterns is expected as a result of this mapping. The maps will be useful to territorial geological administrations and trusts as a basis for a detailed metallogenetic prediction in their areas and in preparing long-term plans for specialized and geological prospecting work. Work on atlas compilation is proceeding. The editorial board is headed by Academician A. L. Yanshin. Map compilation groups have been formed for individual regions of Siberia. The work will be completed in 1983, together with work on the monograph TEKTONIKA I EVOLYUTSIYA ZEMNOY KORY SIBIRI (Tectonics and Evolution of the Earth's Crust in Siberia).
[88-5303]

AEROSPACE METHODS USED IN EXPLORATION FOR PETROLEUM AND GAS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 11, 1979 pp 85-88

[Article by A. A. Romashov and V. A. Demidov, "Aerogeologiya" Trust, "Aerospace Methods in the Complex of Petroleum and Gas Exploration Work in Study of the Structure of the Southeastern Russian Platform"]

[Abstract] The experience of Soviet and foreign researchers shows that the adoption of aerospace methods into practical exploration work increases the quality and effectiveness of search for petroleum and gas and ensures a decrease in expenditures. Use of aerospace data is particularly useful in studying the deep structure of petroleum and gas regions covered by a sufficiently thick mantle of young formations, such as the southeastern part of the Russian platform, for which it is possible to compile general and regional phototectonic maps which reveal the structure of many

formations situated at a rather considerable depth. The best results are obtained with a combining of aerospace and traditional geological and geophysical methods. An analysis of geological-geophysical materials for the southeastern part of the Russian platform revealed a clear-cut correlation between the vertical migration of hydrocarbons and the tectonic peculiarities of the region, and especially dislocations. The availability of sets of aerospace materials (photographs, photomaps, photomosaics) at different scales for individual regions makes it possible in certain cases to make reliable determinations of zones of development of faults and groups of anticlinal structures accompanying them. A very clear example of such an approach was the KOSMOFOTOTEKTONICHESKAYA KARTA ARALO-KASPIYSKOGO REGIONA (Space Phototectonic Map of the Aral-Caspian Region) at a scale of 1:2 500 000, published in 1978. On that map, within the limits of the Caspian Depression and adjacent regions, it is easy to make out a quite complex network of regional faults and the spatial interrelationships between the structures of the sedimentary mantle and fault systems. On aerial and space photographs, despite the complexity of the geological structure of domes in their spatial distribution, it is possible to note a linearity, especially in the marginal parts of the Caspian Depression. In that area salt ridges and groups of domes frequently mark zones of development of faults in the subsalt bed and even the basement. Thus, linear zones or groups of salt dome or other local structures along regional faults, established using aerospace methods, help in determining the patterns of distribution of sectors with increased or more intensive vertical migration of hydrocarbons. The use of aerospace materials at different scales makes it possible not only to establish and trace such linear zones, but also to study their internal structure and characteristics and to classify them with respect to genesis and type. Such a multisided and systemic approach will afford a possibility for the most objective characterization of zones of deep faults and their systems, having fundamental importance in the distribution of petroleum and gas deposits. References: 10 Russian.
[103-5303]

SPACE MAPPING OF TECTONIC STRUCTURE OF URAL-VOLGA INTERFLUVE

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 11, 1979 pp 116-118

[Article by Ye. S. Przhiyalgovskiy and G. N. Rozanova, All-Union Scientific Research Institute for Geological Survey, "Tectonic Structure of the Southern Part of the Ural-Volga Interfluve According to Space Geological Data"]

[Abstract] The southern part of the Ural-Volga interfluve is promising for the exploration for petroleum and gas. A many-sided analysis of data on the structure of the deposits above and below the salt and the results of interpretation of space photographs was carried out for a more precise

determination of the geological structure of this territory. The interpretation of small- and medium-scale space photographs taken from the "Salyut-4" orbital station and "Meteor" artificial satellites was carried out for detecting dislocations (lineaments) in the sedimentary mantle of the Caspian Depression. On the space photographs lineaments were discriminated on the basis of the change in the pattern or phototone of the image and from zones of anomalous phototone or pattern. A comparison of the results of interpretation with data on structure of the complex above the salt indicated that dislocations of northwesterly and northeasterly strikes usually control regional structures. A figure in the text is a map of the regional structure of the complex above the salt for this interfluve region. In addition to the lineaments identified with dislocations, interpretation of the space photographs revealed six annular (closed and unclosed) anomalies which agree with the regional structure of the complex above the salt or coincide with arcuate chains of salt domes. Along the main refracting horizon most of the detected annular anomalies seemingly correspond to isometric positive or negative structures beneath the salt. A comparison of the structures in the complexes beneath the salt and above the salt revealed a change in the general strike of the regional structures from sublatitudinal in the subsalt deposits to primarily northeasterly in the deposits above the salt. In the structure of the complex beneath the salt the main role is played by sublatitudinal dislocations, whereas in the deposits above the salt the main role is played by dislocations with northeasterly and northwesterly directions. Seven petroleum deposits have been discovered in the southern part of the Ural-Volga interfluve. As indicated on the map, these deposits and promising structures are situated in zones of faults and some of them at the intersection of faults. This makes it possible to relate the formation of pools in the complex above the salt with the vertical migration from deposits beneath the salt. Figures 1; references: 3 Russian.
[103-5303]

REMOTE METHODS FOR STUDYING GEOLOGICAL STRUCTURE OF PETROLEUM-GAS REGIONS

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 10, 1979 pp 69-78

[Article by V. I. Gridin and N. A. Yeremenko, "Remote Methods for Studying the Geological Structure of Petroleum- and Gas-Bearing Regions"]

[Abstract] The Aerospace Service of the Petroleum Industry Ministry is carrying out a broad range of studies. They include the development and testing of methods and apparatus for the remote study of petroleum- and gas-bearing regions. The scientific methods and technological procedures of remote sensing are being employed on an experimental basis by the specialized territorial subdivisions of the ministry. The most significant results have been obtained within the limits of the Dneprovsko-Pripyatskaya

petroleum and gas province. A map of the tectonic structure of the Pripyatsko-Dneprovsko-Donetskiy aulacogen was compiled on the basis of aerospace materials and is reproduced in this article. Even in regions already being exploited by the petroleum industry and which have been studied in depth, the combining of remote and traditional methods is affording a possibility for obtaining new information on deep structure, and on this basis, make a more precise determination of the location of known petroleum structures and to detect new structures with a sufficiently high degree of reliability. The confirmability of photoanomalies by geological-geophysical work is 80-90%. Within the limits of the province aerospace investigations revealed 324 local anomalies. A total of 128 anomalies were recommended for checking, 54 were checked and 44 were confirmed. Positive results in the use of remote methods in petroleum exploration work were also obtained in other petroleum- and gas-bearing provinces and regions. These are discussed in the article. General and regional study of petroleum- and gas-bearing basins is assisting in the inventorying and reinterpretation of geological-geophysical materials on a unified basis for the entire basin, in clarifying problems related to the neotectonic and tectonic regionalization, in making known dislocations more detailed and detecting new regional dislocations, in compiling maps of tectonic regionalization and prediction of the presence of petroleum and gas for the scientific validation of future geological prospecting work and also in more precise determination of known and detection of new directions in petroleum exploration work for long-range planning purposes. Similar goals are achievable on regional and smaller scales.
[88-5303]

THEORETICAL ANALYSIS OF DEVELOPMENT OF SHEAR WAVES AT EARTHQUAKE FOCUS

Alma-Ata VESTNIK AKADEMII NAUK KAZAKHSKOY SSR in Russian No 10, 1979 pp 24-31

[Article by Zh. S. Yerzhanov, N. Zh. Zhubayev and A. S. Kim, "On the Theory of Development of Shear Waves at an Earthquake Focus"]

[Abstract] The focus of a tectonic earthquake is usually considered a rapid dynamic rupturing of a rock mass under the influence of stresses accumulating in the course of slow shear deformations and its possible mechanisms are determined without taking into account the viscous interaction of the sides of the fracture. However, in the modern science of the mechanics of destruction the formation of a main fracture is studied in relation to the subsequent interaction (slippage) of its sides. Experiments indicate the importance of analysis of such interaction even in a qualitative description of an earthquake focus. The destruction of any deformable solid body is accompanied by irreversible processes often exerting a decisive influence on the wave pattern. Allowance for interaction of the fracture sides can introduce substantial corrections into the determination of earthquake focus characteristics. This paper is devoted to the problem of applying the techniques employed in analysis of destruction processes in the modern science of mechanics for a more scientific investigation of the formation of shear waves during the focal zone fracturing of rocks, in particular, taking into account the interaction between the sides of the fracture, an important factor which heretofore has been neglected. Formulas are derived for describing these phenomena. Figures 1; references: 13 Russian. [81-5303]

METHOD FOR ANALYSIS OF STRUCTURE OF SEISMIC FIELD

Moscow NEFTEGAZOVAYA GEOLOGIYA I GEOFIZIKA in Russian No 9, 1979 pp 32-37

[Article by L. P. Dunayeva, All-Union Scientific Research Institute of Geophysics, "Analysis of Structure of the Seismic Field from the Nature of Correlation of Reflections"]

[Abstract] The interval in which waves can be traced can be used as a criterion in the search for anomalous zones caused by a change in the reflecting properties of the discontinuity and the nature of the above-lying stratum. The method proposed for this purpose is designated here as the P_L method. This method makes it possible to discriminate zones of variability of field structure by defining within the limits of the investigated stratum such a set of characteristics of this field as will characterize local inhomogeneities of a definite type, such as tectonic dislocations and deposits of petroleum and gas. The article presents a schematic model of the seismic field in the form of sectors of a time section on three reception bases. The cophasal axes, traced along the profile, are important indicators. In a visual examination of the model it is possible to note qualitative changes in field structure on individual reception bases. However, for describing the degree of difference of such sectors and detecting insignificant changes which cannot be detected visually it is necessary to have quantitative evaluations of these changes. Such evaluations can be the total number of axes (N) and their average extent ($\bar{L}$). In the P_L method there is statistical processing of the field of cophasal axes with respect to their extent (L). A method is proposed for processing of the seismic record which involves analysis of the irregular part of the seismic record by an examination of the interval in which the cophasal axes can be correlated and finding different statistical characteristics of the distribution of the "extent" (L) parameter. The number of regular reflections is separately analyzed. The method makes it possible to detect zones of local variability of field structure against the background of its random changes within the investigated stratum. The P_L method uses the "extent" parameter as a random value for describing field structure and a comparative evaluation of its changes. Figures 4; references: 6 Russian. [100-5303]

RECENT MOVEMENTS OF EARTH'S SURFACE IN UZBEKISTAN

Tashkent UZBEKSKIY GEOLOGICHESKIY ZHURNAL in Russian No 4, 1979 pp 13-16

[Article by D. Kh. Yakubov and A. R. Yarmukhamedov, Seismology Institute, Academy of Sciences Uzbek SSR, "Manifestations of Recent Movements of the Earth's Surface in the Geodynamic Polygons of Uzbekistan"]

[Abstract] The geodynamic polygons of Uzbekistan are situated under different geological-tectonic conditions: Kyzylkumskiy -- within the limits of the Turanskaya Platform, Tashkentskiy -- in the transition zone between the West Tien Shan orogeny and the Turanskaya Platform, Furganskiy -- within an orogenic downwarp. In all the polygons, according to the results of geodetic measurements, the activation of recent movements is nonuniform. For example, in the Tashkentskiy polygon, according to the results of repeated second-order leveling, after the Tashkent earthquake the earth's surface rose +37.3 (±7.6) mm in 1966, but only +11.5 (±6.6) mm in 1971. The change in the elevation of the leveling marks during 1967-1970 and during 1970-1971 varied in direction and in many cases was insignificant. The rates of recent tectonic movements in the polygons are different: in the Kyzylkumskiy polygon, in the lowlands, from +2-3 to -2-4 mm/year; in the mountains +12-15 mm/year; in fault zones +18-22 mm/year. In the Tashkentskiy polygon, in the lowland zone, the rate is +15 mm/year; foothills +10-15 mm/year; mountains -60 mm/year; fault zones -30 mm/year; movements associated with seismic phenomena -- more than 40 mm/year. In the Ferganskiy polygon, in the lowlands the rate is +1-15 mm/year, in depressions up to -10 mm/year, foothills 20-24 mm/year, in fault zones 30-40 mm/year. References 13 Russian.
[94-5303]

APPLICATION OF RADIOMETRIC METHODS IN STUDYING RECENT MOVEMENTS

Tashkent UZBEKSKIY GEOLOGICHESKIY ZHURNAL in Russian No 4, 1979 pp 3-5

[Article by S. M. Kasymov, N. A. Latypkhodzhayev, N. P. Kostenko, S. Saydaliyev and S. S. Abdurakhmanov, Seismology Institute, Academy of Sciences Uzbek SSR, "Use of Radiometric Methods in Geophysics in Studying Recent Movements"]

[Abstract] The article presents the results of study of recent movements by a combined method (radiometric, emanation survey, geodetic measurements) in the construction area of the Novo-Angrenskaya State Regional Electric Power Station. The investigated area consists of deposits which are diverse with respect to age and genesis. Geophysical measurements were made along profiles separated by a distance of 300-500 m (radiometric survey) and along a closed contour (emanation survey). In order to carry out second-order repeated leveling 17 benchmarks were established

in the area in a closed contour. The first measurement of elevations was in October 1977 and the second in June 1978. The curves of radiometric, emanation surveys and repeated leveling correlate well. The constructed maps clearly reveal zones of northeasterly, northwesterly and meridional direction. All the defined zones are active at the present stage in geological development. The results of repeated leveling indicate that the western part of the investigated area is rising intensively relative to the eastern part. It is concluded that radiometric methods are entirely applicable in the mapping of active geodynamic zones where tectonic movements are occurring at the present stage. Figures 2; references 6 Russian. [94-5303]

ANOMALOUS MAGNETIC FI''D IN NORTHWESTERN TURKMENISTAN

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-TEKHNICHESKIKH I KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 5, 1979 pp 72-78

[Article by Ye. V. Shtan'ko, Seismology Institute Academy of Sciences Turkmenskoy SSR, "Anomalous Magnetic Field of the Territory of Northwestern Turkmenistan and its Informativeness on Deep Structure of the Earth's Crust"]

[Abstract] The author describes the distribution of magnetic inhomogeneities in the earth's crust in northwestern Turkmenistan along three seismic profiles on the basis of the results of scaling the magnetic field into the upper half-space with a 2-km interval to an altitude of 8 km, with an interval of 4 km to an altitude of 24 km and 6 km to an altitude of 60 km. It was possible to construct diagrams of magnetic field distribution in the vertical plane, construct curves of field change at different scaling levels and formulate approximate magnetic models along the mentioned profiles. It was found that regional and large positive anomalies of the field transformed in an upper direction correspond to deep faults with roots extending to the mantle. Intermediate and small positive anomalies correspond to fractures in the basement and possible small intrusions along them. By analyzing curves of field change at different scaling levels and comparing them with available seismic data it is possible to note the following pattern: on the curves a great number of known basement fractures correspond to points of intersection and change in the sign of the anomaly. Some of the faults detected by seismic prospecting are not reflected in the upward-scaled magnetic field since they evidently are unrelated to the impregnation of magnetic rocks. On the basis of data from scaling of the magnetic field into the upper half-space, in the first approximation it is possible to formulate the following magnetic model of the earth's crust in northwestern Turkmenistan. Horizontally the crust can be divided into three sectors bounded

by deep faults; on the profiles these correspond to blocks different in their magnetic properties and creating large anomalies of different sign. The blocks are nonuniform in structure and possibly in the composition of the rocks making up the crust, in both the upper part and at great depths. It is clear that by analyzing the nature of the distribution of the magnetic field at great scaling altitudes it is possible to discriminate large magnetic inhomogeneities at different depths, which facilitates the detection of structural peculiarities and the composition of the earth's crust. Figures 3; references: 10 Russian.
[64-5303]

CORRELATION BETWEEN STRONG EARTHQUAKES AND SOLAR WIND PARAMETERS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 249, No 4, 1979 pp 821-824

[Article by A. D. Sytinskiy, Arctic and Antarctic Scientific Research Institute, "Correlation Between Strong Earthquakes and Solar Wind Parameters"]

[Abstract] In earlier studies (GEOMAGNETIZM I AERONOMIYA, Vol 3, No 1, 148, 1963; DAN, Vol 209, No 5, 1078, 1973; UFN, Vol 111, No 2, 367, 1973) the author established and statistically demonstrated the influence of solar activity on seismic phenomena. It was found that the total seismic activity of the earth, expressed through the total energy of earthquakes and the number of catastrophic earthquakes per year, is dependent on the phase of the 11-year solar activity cycle. In addition, there is a statistically significant correlation between the time of occurrence of strong earthquakes and the existence and position of active regions on the sun. In particular, it was established that there is a correlation between the time of occurrence of strong earthquakes and the transit of active regions across the sun's central meridian. Now continuing his earlier work, the author examines the problem of the correlation between strong earthquakes and solar wind parameters using data published by King. It is shown that the earlier established correlation between the earth's seismicity and solar activity, and especially the correlation between the time of occurrence of strong earthquakes and transit of active regions across the central meridian can be attributed to variations of solar corpuscular radiation. In the case of earthquakes it is not simply high-velocity streams of solar plasma, with which geomagnetic disturbances are associated, which are geoeffective, but also the density of the energy flux of corpuscular radiation. The data presented in this paper make it possible to postulate that the influence of solar activity on seismic phenomena is realized due to the direct energy effect of corpuscular solar radiation on the earth's atmosphere. All the data presented here reinforce the proof of a correlation between the earth's seismicity and solar activity. Thus, strong earthquakes are not only a purely geological, but also a solar-

terrestrial phenomenon. It can be expected that strong earthquakes can be accompanied not necessarily only by strong magnetic storms, but also by different electromagnetic, including magnetospheric and aeronomic processes. Further investigations in this direction seem quite promising. Figures 3; references 13: 11 Russian, 2 Western.
[116-5303]

HF ELECTROMAGNETIC RADIATION ACCOMPANYING SEISMIC ACTIVITY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 248, No 5, 1979 pp 1077-1081

[Article by M. B. Gokhberg, V. A. Morgunov and Ye. L. Aronov, Institute of Physics of the Earth, "High-Frequency Electromagnetic Radiation Accompanying Seismic Activity"]

[Abstract] In earlier studies it was noted that an anomalous high-frequency electromagnetic radiation is observed in the range of radio waves during the period of preparation and development of seismic activity. The registered signal has a pulsed character, indicating the feasibility of its study in a broad range of radio frequencies. Experimental studies for investigation of high-frequency electromagnetic fields were carried out by an expedition of the Institute of Physics of the Earth in Dagestanskaya ASSR during August-October 1978. Synchronous registry was with use of three complexes of standard radio receiving apparatus tuned in different ranges in the frequency band 10^4-10^6 Hz. The receivers and antennas were in a mine drift 50 m from the mouth. During the observation period there was a strong earthquake in Iran at a distance of 1,200 km. During the time preceding the earthquake there was a stable background level at the selected frequencies. Just 55 minutes before onset of the earthquake there was an anomalous disturbance of the background simultaneously at three frequencies, which activity gradually increased, attaining the maximum level a few minutes prior to the first tremor. The rate of tape movement made it possible to study the dynamics of the process. Upon completion of the most intensive phase of the earthquake the signal level at frequencies 27 KHz and 1.6 MHz decreased sharply. The problem of the source of this electromagnetic radiation during seismic activity is fundamental. The pulsed nature of the signal gives basis for assuming a discharge or relaxation mechanism of its generation. This sort of signal can arise in the atmosphere near the surface or in the depths of the earth's crust. Intensive electromagnetic emissions can emerge at the surface. In this case the greatest signal intensity must be expected over areas with the greatest resistivity near the epicentral region. Figures 2; references 13: 8 Russian, 5 Western.
[102]

VELOCITY CHARACTERISTICS OF CRUST IN ISSYK-KUL' DEPRESSION

Frunze IZVESTIYA AKADEMII NAUK KIRGIZSKOY SSR in Russian No 3, 1979 pp 34-40

[Article by K. Moldobekov and I. Sadybakasov, Seismology Institute Kirgiz Academy of Sciences, "Velocity Characteristics of the Earth's Crust in the Issyk-Kul'skaya Depression Using Data from Shots and Earthquakes"]

[Abstract] This paper presents the results of study of the wave fields accompanying shots and earthquakes. Using an analysis of theoretical and experimental travel-time curves the authors examine possible models of a change in velocity with depth. The records of four shots were studied. The observation system consisted of four expeditionary stations and one fixed station. One profile runs along the strike of the Issyk-Kul' depression, and one profile runs across the strike. Figure 1 is a map of the depression, the location of the seismic stations and profiles. Figure 2 shows geological sections of the upper part of the crust compiled on the basis of available geological and geophysical data. The characteristics of the wave fields along the profiles are considered in detail. The data obtained in this study indicated that the thickness of the Cenozoic cover is in the range 1-1.5 km with a mean wave velocity 5.0 km/sec. At a depth of 2 km the rocks have higher velocity characteristics. This layer of about 3 km corresponds to rocks of the Middle Paleozoic, consisting of volcanic-terrigenous deposits of the Devonian and Carboniferous. Then, judging from the velocity gradient and available geological-geophysical data, gneiss rocks begin (wave velocity 5.8-6.1 km/sec). Information on deep discontinuities was obtained from records of remote stations. The theoretical and experimental travel-time curves constructed for depths 5, 10, 15, 20 km agree well. The data obtained from this field work, by registry of shots and earthquakes, is consistent with data in the literature. Figures 4, Tables 1; references: 5 Russian.
[87-5303]

AUTOMATION OF RADIOGEODETIC MEASUREMENTS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 12, 1979 pp 14-17

[Article by V. N. Balandin, R. D. Volodarskiy, N. P. Godisov and V. V. Mekhanikov, "Automation of Radiogeodetic Measurements"]

[Abstract] The total automation of radiogeodetic measurements includes the following operations: conversion and coding of signals received from the radiogeodetic system (RGS) and recorded by an analog recorder; input of the converted signals into a counter with a digital electronic display, puncher and electronic computer; computation of the coordinates of the points to be determined; printout of the results. Full automation of this type has been achieved by the introduction of a complex developed in the

Section on Survey of the Shelf and the World Ocean of the Central Scientific Research Institute of Geodesy, Aerial Mapping and Cartography in 1976-1978 and called the autocoordinator. This apparatus is illustrated in the text and its components and operation are briefly described. The autocoordinator is intended for automation of the determination of coordinates of a carrier of survey apparatus. The operating principle is based on the conversion of signals received from the "Poisk" RGS into a binary-decimal code with subsequent computation on an electronic computer and the printout of coordinates and time. The autocoordinator has the following technical specifications: current from a-c network -- 220 V/50 Hz; consumed power -- 400 W; measurement accuracy -- 0.01 phase cycle; operating temperature regime -- +10 - 35°C; time of continuous operation — 16 hours; total mass -- 100 kg; size -- 145 x 80 x 50 cm. Several modifications of the autocoordinator have now been developed. Shipboard tests of the apparatus were carried out in 1978 on two ships in the Black Sea. The coordinates of more than 5,000 survey points were obtained. The tests revealed a high reliability of operation of the apparatus on ships with a displacement greater than 100 tons with waves at sea up to class 4-5. The autocoordinator has been introduced into the work of a number of enterprises of the Main Administration of Geodesy and Cartography, Geology Ministry, USSR State Committee on Hydrometeorology and Environmental Monitoring and elsewhere. Figures 1; references: 6 Russian.
[159-5303]

ACTIVATION OF WEAK SEISMICITY AS PREDICTOR OF STRONG EARTHQUAKES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 249, No 6, 1979 pp 1335-1338

[Article by I. L. Nersesov, Yu. M. Teytel'baum and V. S. Ponomarev, Institute of Applied Geophysics, "Forerunning Activation of Weak Seismicity as a Predictor of Strong Earthquakes"]

[Abstract] The possibility of predicting large earthquakes on the basis of forerunning (precursor) swarms of tremors was investigated using data from seismological observations carried out during 1955-1976. The strong earthquakes included in the investigation were 26 events with K = 12-14. The time interval between the appearance of a forerunning swarm and the main event fluctuates in the range 0-18 months. Two types of time sequences of earthquakes can be discriminated: 1) activation of weak seismicity ends long before the appearance of the main tremor; 2) activation increases virtually up to the time of a strong earthquake. The quite high stability of the appearance of forerunning swarms indicates the possibility of their use in predicting earthquakes. The effectiveness of this predictor increases considerably when the swarms are analyzed jointly with periods of seismic "calms." This is illustrated in specific cases observed in the Germ region. It was found that the two different sequences of earthquakes

are governed by the prevailing strength properties of rocks. In the northern part of the region, consisting of more consolidated rocks, the time sequences of earthquakes tend to the first type. In the southern part of the region, covered with a thick bed of sedimentary rocks, sequences of the second type are observed. Figures 3; references 11: 8 Russian, 3 Western. [176-5303]

STRUCTURE OF FIELD OF STRESSES AT FOCUS ACCOMPANYING SHOT IN SOFT GROUND

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 11, 1979 pp 28-38

[Article by Yu. I. Vasil'yev, L. V. Molotova and M. N. Shcherbo, Institute of Physics of the Earth, "Structure of Field of Stresses at the Focus and Focal Parameters Accompanying Shot in Soft Ground"]

[Abstract] The authors investigated the extent and structure of the focal region of a shot from records of stresses and strains in soft ground. The shots (up to 1 kg of explosive) were set off in holes at the same depth at which the sensors had been placed. It was found that in the focal region of a shot the relationship of the circular and radial components of stress in dry ground differs from that anticipated for the case of an elastic spherical wave. This fact is also confirmed by experiments in rosin. A comparison of the experimental results obtained in the ground and in rosin indicated that the difference from elastic theory is primarily that in the circular component of stress with advance into the inner part of the real focus there is development and intensification of the compression phase and the dilatation phase gradually lessens. In dry ground, as in rosin, it is evidently necessary to distinguish two focal regions: internal and external. In the inner region the destruction of the medium occurs primarily as a result of shearing, the plasticity condition is satisfied, the circular component of stresses is a compressional stress, as is the radial component. In the outer region of the focus, according to data from experimental investigations in dry ground, there are considerable, up to 2.5 kg/cm^2, circular dilatational stresses; the plasticity condition is not satisfied, as in the elastic region. By means of direct measurements of stresses and strains it was possible to determine the focal parameters in dry ground necessary for calculating the radiation of an elastic wave. [107-5303]

DETERMINATION OF PARAMETERS OF GEOCENTRIC SYSTEM OF GEODETIC COORDINATES

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 5, 1979 pp 30-34

[Article by M. M. Mashimov, K. V. Malets and A. I. Shvets, Red Banner Military Engineering Academy, "Possibilities of Determining the Parameters of a Geocentric System of Geodetic Coordinates by Modern Geodetic Methods"]

[Abstract] The position of the earth's center of mass, angular elements of orientation and semimajor axis of the general terrestrial ellipsoid are determined with the best evaluation with the joint use of observations of artificial earth satellites, the results of satellite leveling, data from the astrogeodetic network and gravimetry. Systematic errors in the positions of space geodetic network (SGN) points somewhat reduce the accuracy in determining the sought-for parameters with a considerable lessening of their influence. A highly accurate determination of the position of the earth's center of mass and orienting angles is attained by the use only of astrogeodetic observatories (AGO) and the SGN if they have insignificant random and systematic errors. In order to evaluate the semimajor axis of the general terrestrial ellipsoid it is desirable that the SGN be determined by a geometric method making possible the most precise evaluation of the relative positions of its points. With the joint use of AGO and SGN data and satellite leveling the effectiveness of including gravimetric data in the processing is insignificant. The best evaluation of the parameters of a geocentric system of geodetic coordinates is attained by satellite leveling, making it possible to localize the influence of SGN systematic errors, especially their influence on the evaluation of the semimajor axis of the terrestrial ellipsoid. If the SGN is not encumbered by systematic errors, for an evaluation of the parameters of the geocentric system it is sufficient to have satellite leveling data for individual regions of the world ocean. Making joint use of SGN and AGO data, as well as satellite leveling and gravimetry, it is possible to determine the geoid with an accuracy to 1-3 m, depending on the errors in the above-mentioned data. Figures 1, Tables 1; references 7 Russian.
[126-5303]

TEMPORAL VARIATIONS OF HIGH-FREQUENCY SEISMIC NOISE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 11, 1979 pp 72-77

[Article by L. N. Rykunov, O. B. Khavroshkin and V. V. Tsyplakov, Institute of Physics of the Earth, "Temporal Variations of High-Frequency Seismic Noise"]

[Abstract] A special highly sensitive apparatus was created by the authors for studying variations in the level of high-frequency microseisms with time. From a piezoelement of a nonstandard horizontal seismograph, which was oriented in a north-south direction, the signals were fed through a preamplifier to three narrow-band filters tuned to frequencies 27; 30; 15; 33 or 15.07; 60.2 Hz with a transmission band $\Delta f = 0.1$ Hz. The envelopes of signal amplitudes were recorded with an automatic recorder. Minute time marks from a chronometer were fed to the fourth channel of the automatic recorder. The dynamic range was determined for the most part by the automatic recorder and was about 20 db. The amplification factor was about 10^9-10^{10}. The experiment was carried out from May through September 1976. The instrument was installed in the frequency and time standard cellar in an observatory in a wooded area near Moscow. In order to reduce noise associated with man's activity the recording was done on Saturdays and Sundays and at nighttime. The total volume of the record was not much more than 20 days. This revealed a number of peculiarities in the behavior of the level of high-frequency noise. The amplitude of the noise envelope or level is a variable parameter, although over the course of prolonged time intervals, up to several days, it is characterized by a relative constancy. In some time intervals there are slowly changing level variations, weakening and increase in the level by a factor of 3-5. In addition to the slowly changing variations, at definite moments in time after individual strong earthquakes with a magnitude $M \sim 7$ the noise level was disturbed by some periodic process with a level increase by more than a factor of three, sometimes exceeding the dynamic range. It is postulated that a possible mechanism for the appearance of high-frequency seismic noise and the increase in its level may be microseismic emission, a process associated with defects in crustal structure, similar to acoustic emission, the process of radiation of mechanical waves by a material, caused by local dynamic restructuring of the internal structure of a material. When there are stresses close to critical and additional periodic effects leading to supercritical stresses it is apparently possible to expect the observed periodic increases in the level of high-frequency seismic noise. Figures 3; tables 1; references 26: 20 Russian, 6 Western. [107-5303]

RADIATION OF COMPRESSIONAL AND DILATATIONAL WAVES BY SHEAR FAULT

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 11, 1979 pp 13-27

[Article by O. G. Shamina, A. A. Pavlov and R. V. Khanutina, Institute of Physics of the Earth, "Characteristics of Radiation of Compressional and Dilatational Waves by a Shear Fault"]

[Abstract] The field of longitudinal waves radiated by a shear fault was investigated using models. The experiments were carried out using samples of plexiglass measuring 90 x 90 x 8 mm and 150 x 150 x 10 mm in which there were cracks 16 to 30 mm in length at the center of the sample or diagonally displaced. Insofar as known to the authors, there has never

before been any experimental or theoretical comparison of the fields of displacements and accelerations for a shear fault. The model investigations are described in detail. They confirm the assumption made by seismologists that in the case of a shear fault the "detachment" component of displacement can play a significant role in the radiation of elastic waves. The modeling results show that with deviation of the nodal planes from a mutually perpendicular position by about 10°, which is within the limits of the error in their determination in seismological observations, the amplitudes for these compressional waves can exceed the amplitude of the dilatational waves by a factor of approximately 2. In the investigated model the "detachment" component presumably appeared due to the spreading apart of the sides of the shear fault. On the basis of seismological data it is demonstrated that for small crustal earthquakes the compressional waves on the average are stronger than the dilatational waves. Figures 8; references 16: 11 Russian, 5 Western.
[107-5303]

IV. PHYSICS OF ATMOSPHERE

DEPTH OF PENETRATION OF ELECTRONS ARTIFICIALLY INJECTED INTO IONOSPHERE

Tbilisi SOOBSHCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian Vol 96, No 1, 1979 pp 77-80

[Article by T. G. Adeyshvili and G. P. Milinevskiy, Abastumani Astrophysical Observatory, "Depth of Penetration of Electrons Artificially Injected in the Earth's Ionosphere"]

[Abstract] In experiments with the injection of electron beams in the ionosphere from aboard a rocket an important parameter is the altitude of the lower boundary of the rays of the artificially induced aurora. This parameter characterizes the depth of penetration of injected electrons into the earth's atmosphere and can be evidence of presence of a rocket potential and the role of beam-plasma collective interaction at the time of injection. The results of the first Soviet electron experiment in the ionosphere with the "Zarnitsa-1" (A. T. Nesmyanovich, et al., KOSMICHESKIYE ISSLEDOVANIYA NA UKRAINE, No 12, 83, 1978) demonstrated good agreement between experimental data on the position of the lower boundary (H_{bound}) of rays of the artificial aurora (AA) and the theoretically computed values. However, in some segments of the rocket trajectory there are considerable discrepancies. This article gives some results of determination of H_{bound} from TV observations during the experiment "Zarnitsa-2" and gives a qualitative analysis of the difference between the experimental and theoretically computed positions. The experiment "Zarnitsa-2" with injection of an electron beam and cold plasma from aboard the MR-12 rocket was carried out on 11 September 1975 at "Volgograd" sounding station. With injection of electrons in the optical range AA rays and glow around the rocket are observed. The optical observations were made using highly sensitive TV apparatus situated at two points separated by a distance of 100 km. The H_{bound} values were computed for both points from photographs of the AA rays by the method of determining the altitude of the lower boundary from one point: from the rocket coordinates and geomagnetic field parameters. The results are shown in a figure. Computations were made using the CIRA-72 atmospheric model. Comparison of the measured and computed H_{bound} positions demonstrates a good agreement of data in the apogee region and on the descending branch of

the trajectory. But on the ascending branch the measured and computed H_{bound} values differ considerably. It is concluded that on the ascending branch a considerable role in the processes accompanying injection is played by the gas release from the rocket body and engine. The more intensive gas release during rocket ascent and the formation of a trail along the trajectory can lead to an increase in the role of collective interaction between the beam and the surrounding plasma and this in turn exerts a significant influence on the parameters of the injected electrons. Figures 1; references 8: 6 Russian, 2 Western.
[143-5303]

METHOD FOR DETERMINING ELECTRON DENSITY PROFILE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19, No 6, 1979 pp 1012-1015

[Article by V. V. Belikovich, Ye. A. Benediktov, T. L. Gulyayeva and G. I. Terina, Gor'kiy Radiophysics Institute and Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Determination of the Electron Density Profile from the Resonance Scattering of Radio Waves and Vertical Sounding Ionograms"]

[Abstract] The paper describes the method employed and gives the first results of joint determination of the electron concentration profile in the ionosphere on the basis of resonance scattering of radio waves on artificial plasma inhomogeneities and vertical sounding ionograms. The experiments were carried out at Gor'kiy in the summer and autumn of 1976 and in the summer of 1977. The results indicate that measurements of the electron concentration in the ionosphere by the vertical sounding and resonance scattering methods are in quite good agreement with one another. The joint processing of these data, even with a restriction on the range of determination of the N(h) profile by the resonance scattering method, made possible a considerable increase in the reliability of finding the vertical distribution of electron concentration. It was also found that the resonance scattering method can be used in determining the profile in an adequately broad range of ionospheric altitudes, including the E region and the interlayer depression. Figures 3; references 6: 5 Russian, 1 Western.
[124-5303]

WINTER RADIO WAVE ABSORPTION ANOMALY IN AURORAL ZONE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19, No 6, 1979 pp 1042-1045

[Article by Z. Ts. Rapoport, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Winter Anomaly of Radio Wave Absorption in the Auroral Ionosphere"]

[Abstract] The winter anomaly of radio wave absorption is investigated on the basis of data on midday absorption at Loparskaya in 1959-1967. The measurements were made by the Al method at a frequency of 2.0 MHz during 1959-1967. The results can be regarded as unambiguous evidence that the winter anomaly exists at Loparskaya and in the auroral zone in general. Moreover, there are reasons for concluding that the winter anomaly is dedent on the solar activity phase. In November, at midday, the fraction of regular absorption due to injected particles (and processes associated with this injection) in the case of low solar activity was approximately three times greater than the fraction for which wave radiation is responsible. With an increase in solar activity the role of corpuscular radiation decreases. This role also decreases monotonically during the course of the year -- from winter to summer. Figures 1; 12 references: 3 Russian, 9 Western.
[124-5303]

ATOMIC NITROGEN IN UPPER POLAR ATMOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19, No 6, 1979 pp 1046-1049

[Article by V. N. Balabanova and A. A. Pokhunkov, Institute of Experimental Meteorology and Institute of Applied Geophysics, "Atomic Nitrogen in the Upper Atmosphere in the Polar Region"]

[Abstract] A concentration of atomic nitrogen $\sim 10^9$ atoms·cm^{-3} was found in the nighttime polar thermosphere. The [N] measurements were made at Kheys Island during the polar night (February-March 1977) when the principal energy carriers can be the leaking charged particles and electric fields. The N concentration was determined using a mass spectrometer and the method of luminescent ethylene clouds. The results are summarized in Table 1. The frequency of occurrence of the above-mentioned [N] values is ~50%. There was no distinct dependence of the probability of a high content of N atoms at altitudes 130-170 km on the K-index. The rate of formation of atomic nitrogen by thermal electrons accelerated in electric fields is estimated. The results of the evaluation of the influence of electric fields on aerodynamic processes indicate that the dissociation of N_2 by electrons accelerated in electric fields can evidently be one of the possible sources of a high content of atomic nitrogen in the thermosphere. Tables 2; references 14: 4 Russian, 10 Western.
[124-5303]

CHARACTERISTICS OF POTENTIALS AND ELECTRON FLUXES IN AURORAL MAGNETOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19, No 6, 1979 pp 1064-1069

[Article by Ye. Ye. Antonova, Nuclear Physics Institute, Moscow State University, "Formation of the Longitudinal Potential Difference, Isotropic and Collimated Electron Streams in the Evening Sector of the Auroral Magnetosphere"]

[Abstract] The author has examined the process of formation of the longitudinal potential difference between the magnetosphere and ionosphere in the evening sector in the zone of flow of the longitudinal electric current. The following subjects are examined in detail: development of the potential difference between the magnetosphere and ionosphere; dependence of the flux of ionospheric ions on potential jump in the case of weak leakage into the cone of losses; potential difference along a line of force; fluxes of magnetospheric electrons in auroral arcs; longitudinal monoenergetic electron fluxes at the margins of the auroral arc; kilometer radioemission of the earth and processes in auroral arcs; leakage of longitudinal ion fluxes. The formation of both isotropic and collimated electron fluxes in auroral arcs exceeding 10^{10}-10^{11} $cm^{-2}sec^{-1}$ is explained. There is a direct correlation between the process of formation of electron fluxes exceeding this level and bursts of kilometer radioemission. Figures 1; references 17: 9 Russian, 8 Western.
[124-5303]

ADIABATIC TRANSFER OF AURORAL PARTICLES IN MAGNETOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19, No 6, 1979 pp 1070-1073

[Article by V. G. Il'in and N. K. Osipov, Krasnoyarsk State University and Rostov-on-Don Civil Engineering Institute, "Adiabatic Transfer of Auroral Particles in the Earth's Magnetosphere and Their Leakage Energy"]

[Abstract] The adiabatic transfer of auroral particles in the presence of a uniform electric field is considered. Since earlier studies along these lines have given no estimates of the flux density of accelerated particles, an attempt is made to fill this gap for the very simple case of adiabatic transfer in a dipole field. The relationship between the concentration of auroral electrons in the magnetosphere and the density of leaking fluxes for different regimes of pitch-angle diffusion is considered. The position of the region of the maximum of the concentration of auroral electrons is limited downward by the value $L \approx 6$. A change in the diffusion regime leads to a displacement of the regions of the maximum of the electron concentration to lesser L values. It was possible to ascertain the dependence of the density of the flux of leaking electrons on the values of the L parameter: the maxima of regions of leakage are somewhat

displaced toward greater L values than are the maxima of the density of concentration of accelerated particles. The position of the region of leakage of electrons is determined by three mutually interrelated conditions: plasma energy in the tail of the magnetosphere, convection rate and scattering of auroral particles in the region between the plasma layer and the plasmopause. These same conditions and plasma density in the plasma layer determine the energy of leakage. Figures 3; references 7: 4 Russian, 3 Western.
[124-5303]

ALLOWANCE FOR DOUBLE SCATTERING IN LIDAR SOUNDING

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 15, No 12, 1979 pp 1271-1279

[Article by I. V. Samokhvalov, Siberian Division, Institute of Atmospheric Optics, "Lidar Sounding of an Inhomogeneous Atmosphere With Allowance for Double Scattering"]

[Abstract] One means for increasing the information yield from lidar sounding is separation of the echo signal backscattered by the atmosphere into its individual components, each of which corresponds to a definite multiplicity of scattering. The actual employment of this approach necessitates a rigorous relation expressing the relationship between the intensity of multiple scattering in the reflected signal and the lidar parameters and the optical characteristics of the investigated medium. Some earlier limited studies have been made of this problem, but there were restrictions on the duration and shape of the sounding pulse. Accordingly, the author here examines the most general case of sounding of optically dense media by a pulse of arbitrary duration. A general equation is derived for lidar sounding in a double scattering approximation; it is applicable in the case of sounding of inhomogeneous media. The possibility of discriminating the component determined by double scattering from the total echo signal from the atmosphere is analyzed and it is shown that double scattering yields information on the microstructure of the investigated medium. The article gives examples of computations of the intensity of double scattering in the case of reflection of sounding pulses from clouds. These examples show that double scattering is essentially dependent on the distance to the sounded cloud. Figures 4; references 18; 10 Russian, 8 Western.
[151-5303]

V. ARCTIC AND ANTARCTIC RESEARCH

SOVIET POLAR EXPLORERS TO INVESTIGATE EAST ANTARCTICA

Moscow TASS in English 0914 GMT 22 Jan 80

[Text] Leningrad, January 22, TASS. The diesel-electric ship "Mikhail Somov" today moored at the ice-covered water front of the Filchner ice shelf in the Antarctic Weddell Sea. It carried a large team of scientists and specialists of the geological-geophysical detachment of the latest Soviet expedition to the "white continent." They activated the seasonal Druzhnaya base located at the glacier and began unloading the ship. A radio message reporting this was received at the Arctic and Antarctic Research Institute in Leningrad.

Druzhnaya will be the main center for comprehensive investigation of the geological structure of a vast region of the eastern Antarctic close to the southern shore of the Weddell Sea. The Soviet Antarctic explorers are going to investigate hundreds of thousands of square kilometers in one and a half or two months and map this territory. Emphasis will be on deep seismic sounding of the rock bed of Antarctica beneath the ice cover with the objective of ascertaining the structure and geological history of the sixth continent.
[173-P]

SCIENTIFIC EXPEDITION TO ANTARCTICA

Moscow TASS in English 1540 GMT 19 Dec 79

[Brief] Leningrad, 19 December, TASS. The roads of the Soviet Antarctic observatory Molodezhnaya, located in Enderby Land, have become reactivated after a six-month lull. The motorships "Bashkiriya" and "Pioner Estonii" arrived there. They brought 250 scientists and specialists to continue research into the nature of Antarctica. Nikolay Kornilov, head of the 25th Soviet Antarctic Expedition, radioed today that a runway is being prepared on the ice floe near the ships. Planes and helicopters will fly 80 kilometers from there to the observatory carrying polar explorers and cargo.

Other ships from the fleet of the 25th Soviet Expedition are expected shortly at the shores of Antarctica. [Text] [Moscow TASS in English 1540 GMT 19 Dec 79 LD]
[171-P]

ADDITIONAL NEWS FROM ANTARCTICA

ANTARCTIC WATCH -- A new shift of workers has begun watch at Bellingshausen station as part of the 25th Soviet Antarctic Expedition. They are to live and work on Waterloo Island. Scientists will be occupied with the organization of the reception point for information from artificial earth satellites. This will be of considerable help to the people drawing up meteorological and ice forecasts for vessels carrying out voyages in the southern ocean. [Text] [Moscow Domestic Service in Russian 1700 GMT 13 Dec 79 LD]

ANTARCTIC STATION -- A Soviet expedition has left Leningrad for the Antarctic. One of its tasks is to set up a new station, called Russkaya. (Vladimir Mikhaylovich Stepanov), the station chief, points out that Russkaya -- the seventh Soviet station in Antarctica -- will be established in a little-studied part of the western Antarctic where permanent observations have never been made. Around-the-clock observations of nature will be made at the station. The 25th Antarctic Expedition is to carry out work to ensure the successful organization of wintering facilities on Cape Berg. Russkaya and Leningradskaya station personnel will do the construction work, after which nine people will remain to winter there. The station will carry out meteorological, telemetric and off-shore ice observations. A physiographic map of the region will be compiled on the basis of the first year's studies. Climatic features will be incorporated. [Moscow Domestic Service in Russian 0900 GMT 17 Dec 79 LD]
[113-P]

5303 -END-
CSO: 1865

END OF FICHE

DATE FILMED

February 21, 1980

Debbie